LSST Variances
May-2019
Cumulative to Date

WBS	BCWS	BCWP	ACWP	SV	CV	SPI	CPI	Explanation	Impact Analysis	Corrective Action	Updated by	Report Date
3.01.03	2,275,017	2,275,017	1,548,415	-	726,601	1.00	1.47	May 2019 CV not included in EAC -$48K cost variance not included in EAC. CV included in EAC The decrease is due to current underrun in QA support of $565K before FY19 and additional reduction in QA support per expected needs in FY19/20 ($678K at completion). Goal has been exceeded.	May 2019 No impact.	May 2019 No corrective action. EAC is still within threshold. PM Assessment Agreed. Closed.	Vincent Riot	31-May-2019
3.02.01	7,136,279	7,136,279	6,821,211	-	315,068	1.00	1.05	May, 2019 CV +$315K cumulative CV with a +$18K CV for May. This is due to earlier under-running of LOE charges for multiple systems integration disciplines. Currently running flat with a CPI of 1.05 for multiple months in a row, but with large over/under variances within the subsystem: System Engin manager: 26 hr over-run on LOE due to delayed phase-off because of on-going management of sub-system technical issues. (Act = 120 hr; Bdg = 94) Requirements mgr: 19 hr under-run and labor rate is lower than baselined budget for more senior SE. (Act = 96 hr; Bdg = 115) Risk manager: 2 hr under-run for the month (Act = 12 hr; Bdg = 14) Document manager: 11 hr over-run for the month (Act = 110 hr; Bdg = 99) Mechanical Systems Integration: 64 hr over-run for the month (Act = 152 hr; Bdg = 88) System EE: 51 hr under-run on LOE account compared to baseline, since costs are covered by direct charges to accounts where work is going on (Act = 24 hr; Bdg = 75)	May, 2019 CV No immediate impact. For this month, CV ~ +$18K. The monthly CV has been trending downward for some time, indicating that our burn rate equals our LOE budgeted amount. This trend will continue, suggesting that our monthly CV will now go negative as we start using up the cumulative +CV over the next 6 months. Long-term impact is that SE accounts will be able to cover SE LOE support further into the I&T phase, supporting I&T efforts after subsystem roll-of.	May, 2019 No corrective action required. Current EAC is commensurate with past performance, and actuals are now running almost even with this. Expect to see the +CV to start trending down over the next few months. PM Assessment Agreed. Closed.	Martin Nordby	31-May-2019
3.03.01	2,413,812	2,413,812	2,281,647	-	132,165	1.00	1.06	May 2019 CV is included in EAC (Approved VAC= +$125K) The $132K positive Cost Variance is mostly related to less expensive labor being used relative to the baseline plan, which is a savings that has been forecasted as far back as 1QFY17.	May 2019 None – The savings is reflected in the EAC forecast.	May 2019 Close Control Account PM Assessment Agreed. This will be closed when control account is formally closed and documented at https://confluence.slac.stanford.edu/pages/viewpage.action?pageId=215843174.	Bill Wahl	31-May-2019
3.03.02.03	636,095	636,095	424,212	-	211,884	1.00	1.50	May 2019 CV is included in EAC (Approved VAC= +$212K) The $212K positive Cost Variance is due to fewer labor hours being charged during the past few periods relative to the number of Sensors that were accepted. In addition, the labor rates identified in the baseline plane reflect a cost that is greater than the cost of the actual labor (labor types & bands) that are being used, which is reflected in the EAC projections. All scope is now complete so there will be no additional charges to the control account.	May 2019 None – The savings is reflected in the approved VAC.	May 2019 Close Control Account PM Assessment Agreed. This will be closed when control account is formally closed and documented at https://confluence.slac.stanford.edu/pages/viewpage.action?pageId=215843174.	Bill Wahl	31-May-2019

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WBS	BCWS	BCWP	ACWP	SV	CV	SPI	CPI	Explanation	Impact Analysis	Corrective Action	Updated by	Report Date
3.04.01.01	4,650,247	4,650,247	4,539,723	-	110,525	1.00	1.02	May 2019 CV exceeds EAC by $27K (Approved VAC= +$83K) The $110K positive Cost Variance is mostly related to less expensive labor being used relative to the baseline plan, which is a savings that has been forecasted as far back as 1QFY17. The $27K difference between the current variance and the approved VAS will likely be used to fund resources through closeout. If not, the unused budget will be returned to contingency.	May 2019 None – The savings is reflected in the EAC forecast.	May 2019 None – Three more months (June, July & Aug 2019) of LOE expenses will likely draw from this positive CV. PM Assessment Agreed. Closed	Bill Wahl	31-May-2019
3.04.01.03	2,469,770	2,469,770	2,898,850	-	(429,080)	1.00	0.85	May 2019 CV is included in EAC (Approved VAC = -$440K) The $430K negative Cost Variance is due to (1) raw board costs are greater than originally planned, (2) a greater number of First Article boards were purchased relative to what was originally planned and (3) more expensive labor was applied to the First Article REB5 boards, including unplanned support from SLAC senior staff (engineers) instead of technicians. In addition, the need for ongoing REB repairs at SLAC has resulted in cost growth, which is reflected in EAC (CV=VAC). All scope is now complete so there will be no additional charges to the control account.	May 2019 None: CV is in good agreement with the approved VAC.	May 2019 Close control account PM Assessment Control account needs to close.	Bill Wahl	31-May-2019
3.04.01.06	4,027,747	3,973,974	2,426,793	(53,773)	1,547,181	0.99	1.64	May 2019 CV exceeds EAC by $338K (Approved VAC = +$1,209,525K) The $1.55M positive CV is mostly related to (1) less expensive labor being used relative to the baseline plan, (2) fewer labor resources required than originally expected (3) significant material cost savings and (4) savings due to shipping two Rafts at a time to SLAC (~10K per Raft).	May 2019 None: CV is greater than the approved VAC by approximately $338K. Raft refurbishment is now complete and closeout activities have begun. Those costs will be funded by the positive CV but if all goes well and further rework is not required, most of the positive CV will be returned to contingency.	May 2019 None – positive VAC will be returned to contingency once scope is complete (August 2019) PM Assessment No Corrective action. Closed	Bill Wahl	31-May-2019
3.04.02.03	2,954,427	2,932,676	2,706,212	(21,750)	226,465	0.99	1.08	May 2019 CV included in EAC (+$250K) 1. -$140K of past underrun due to efficiency in pre-assembling and manufacturing the CRSA parts and components 2. $30k under spending due to re-phase of CR effort 3. $11k under spending due to efficiency in assembly of CRSA 4. $49 Planned CRSA cold metrology has not been performed on CRSA level but will be done at CRTM level. 5. $20k Conversion of EE effort to contributed CV not included in EAC (-$24K) some EE effort planed as contributed could not be realised	May 2019 No impact.	May 2019 account seems will be closed by SEP 2019. PM Assessment Account needs to be closed. Still open.	Sven Herrmann	31-May-2019
3.05.02	5,279,072	4,607,838	4,727,299	(671,235)	(119,461)	0.87	0.97	May 2019: The negative schedule variance ($671k) is primarily attributed to the following milestones. 1) RCV First Article filter coated ($228k) 2) third filter ready to ship from TSESO ($110k) 4) Support delays ($95k) 3) Readiness for coating second filter ($91k) Delays in the metrology system have prevented acceptance of the first article thought the coating is done. The third filter will be ready to ship from TSESO at the end of June.	The impact of the delays is to delay support and extend the completion date for the filters. No impact on project deliverable need dates is foreseen	May 2019: Visit to TSESO to inspect third filter is scheduled to occur in early June. Schedule coordination with coating vendor to ensure acceptance is completed in a timely fashion is required. PM Assessment Visit to TSESO was successful. Monitoring is part of the plan. Closed.	Justin Wolfe	31-May-2019

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WBS	BCWS	BCWP	ACWP	SV	CV	SPI	CPI	Explanation	Impact Analysis	Corrective Action	Updated by	Report Date
3.05.04	3,368,591	2,992,624	2,758,467	(375,966)	234,157	0.89	1.08	May 2019: The negative variance of ($376k) attributed to 1) Procurement support for the L3 lens Phase 4 ($131k) 2) Reciept of L3 lens assembly ($124k) 3) L3 Assembly Vacuum Testing Complete ($81k) Due to fabrication technical problems, which resulted in schedule delays, the assembly was been delayed several months. The L3 lens is currently undergoing integration and is expected to be delivered in June or July of 2019. Vacuum testing will be completed in June.	No impact to camera deliverables is foreseen. The lens assembly will be delivered well prior to current need dates.	May 2019: Subsystem manager to continue to monitor vendor through delivery. PM Assessment Risk OPT-014 mitigation plan is to use schedule float to address manufacturing issues (contract was issued early to allow for this mitigation). Current delays are commensurate with available float to the critical path. Closed.	Justin Wolfe	31-May-2019
3.06.01.02	2,021,698	1,898,840	2,697,231	(122,857)	(798,391)	0.94	0.70	May 2019 Some minor issues discovered during the bonding. They have been resolved	Month 2019 One month delay	May 2019 Share in advance a work plan for the required tech help in order to help I&T with the planning of proved techs to the Camera Body	Marco Oriunno	31-May-2019
3.06.01.02	2,021,698	1,898,840	2,697,231	(122,857)	(798,391)	0.94	0.70	May 2019 Continued shortage of technical manpower due to the reallocation of the technical pool to LSST task with higher priority	May 2019 one month delay	None	Marco Oriunno	31-May-2019
3.06.02.01	199,110	199,110	160,839	-	38,270	1.00	1.24	May 2019 The CAM is able to perform the work with a lower effort	May 2019 None	None	Vincent Riot	31-May-2019
3.06.02.02	2,830,551	2,522,698	3,421,153	(307,852)	(898,455)	0.89	0.74	May 2019 Additional labor required to complete the inventory and procure few missing items.	May 2019 Two weeks	None	Vincent Riot	31-May-2019
3.06.02.02	2,830,551	2,522,698	3,421,153	(307,852)	(898,455)	0.89	0.74	May 2019 Delay with placement of the contract for the painting of the blades. The only shop qualified provided quote with considerable delay. we used a third party to speed up the contract	May 2019 One month	None	Vincent Riot	31-May-2019
3.06.04.02	1,086,468	1,086,468	1,593,661	-	(507,193)	1.00	0.68	May 2019 (Explanation of -$507,193 CV) This number is unchanged from October 2018. The cumulative negative -$507K cost variance in December is due to Cryostat team supporting I&T on BOT integration. RTM stay-clear requirement violation was discovered during the I&T integration. Cryostat and I&T implemented prototypes and final tooling to resolve the interference caused by the cold plate shroud to the RTM. The cumulative CV is due to several months of over-time efforts to mitigate telescope standing army cost and the electro-polishing activities taking longer than estimated.	May2019 (Impact of -$507,193 CV) Cost variance already included in the EAC. No further impact.	May 2019 (Corrective Action of -$507,193 CV) None. Ready to close PA. PM Assessment PA needs to be closed.	Thomas Markiewicz	31-May-2019
3.06.04.05	1,342,496	1,347,626	1,757,902	5,130	(410,275)	1.00	0.77	May 2019 (Explanation of -$410,275 CV) The incremental $8k cost variance in May is due to labor to complete the two spare power feedthroughs; the 4 production feedthroughs were installed in the cryostat in mid-April. One spare has been connectorized as a science raft feedthrough. The last spare would only be connectorized once it was known where, if at all, it is needed.	May 2019 (Impact of -$410,275 CV) The variance in this control account has grown since the last EAC update. A new EAC update is required to assess the project impact. There is only a very little amount of work to do on these two spare power feedthroughs. The labor burn rate should diminish in this account. There may be additional M&S charges in June for epoxy, connectors, etc.	May 2019 (Corrective Action of -$410,275 CV) Update EAC PM Assessment EAC-042 completed. Closed	Thomas Markiewicz	31-May-2019

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WBS	BCWS	BCWP	ACWP	SV	CV	SPI	CPI	Explanation	Impact Analysis	Corrective Action	Updated by	Report Date
3.06.04.06	7,801,469	7,575,261	8,455,246	(226,208)	(879,985)	0.97	0.90	May 2019 (Explanation of -$226,208 SV) -$ 75,714 is non-labor is related to TMA HX and compressors (was -$59k last month) -$ 142,699 is the labor associated with the TMA HXs (was -$128k last month) -$ 7,795 is the labor associated with the I&T compressors and HX (was -$36k last month)	May 2019 (Impact of -$226,208 SV) The I&T HX and compressors are on the critical path. The second of 2 I&T HX was finished and was installed March 15. The 4th I&T Cryo compressor cabinet was competed and installed in IR2 on March 18. Verification & Analysis of the IR2 system is nearly complete. Work is still progressing on the TMA system & it is requiring more labor than that budgeted. Testing of all 8 refrigeration circuits is in progress.	May 2019 (Corrective Action of -$879,985 CV) Understand if the EAC should be adjusted to reflect current understanding of I&T HX costs. Ensure that the contract for TMA HX parts results in better quality parts requiring little to no cleaning, testing and repair at SLAC. Finish qualifying the I&T system as soon as possible. PM Assessment EAC to be reviewed.	Thomas Markiewicz	31-May-2019
3.06.04.06	7,801,469	7,575,261	8,455,246	(226,208)	(879,985)	0.97	0.90	May 2019 (Explanation of -$879,985 CV) The cumulative negative cost variance is attributed to historical cost growth for extra effort associated with the I&T heat exchanger inspection and acceptance testing due to the quality of vendor deliverables. The trend in cumulative cost variance is as follows: November 2018- $442k December 2018 -$670k January 2019 -$593k February 2019 -$704k March 2019 -$739k April 2019 -$796k May 2019 -$880k The turn on of the first cold circuits in late January showed that ancillary systems (heaters, CCS) were not ready and more labor than anticipated was required. In February labor to diagnose leaks in connections to the HX1 Cold/Cryo system at IR2 and in the TMA compressor chassis contributed to increased unplanned costs. Maintenance of oil and refrigerant levels were also required more hours than planned. This trend continued in March as much unplanned labor was needed in IR2 by engineers, technicians, electricians and computer support to bring the systems on-line. There were many leaks in hoses and fittings of the HX2 Cryo/Cryo HX that required diagnostics and repair. From mid-April to present date the labor expended resulted in visible progress in the TMA Cold & Cryo Compressor systems.	May 2019 (Impact of -$879,985 CV) These are real costs.	May 2019 (Corrective Action of -$226,208 SV) The first of 4 shipment of parts for the new TMA HX occurred at the end of May and the parts are expected in early June. We are on track to deliver the TMA cabinets & HX. PM Assessment Agreed. Closed.	Thomas Markiewicz	31-May-2019
3.06.05.01	193,897	193,897	163,155	-	30,742	1.00	1.19	May 2019 (Explanation of +$30,742 CV) UT labor has been directed at power feedthroughs and corner raft problems, resulting in lower than expected spending in this account.	May 2019 (Impact of +$30,742 CV) Reflected in SV of UT Mechanical and Assembly.	May 2019 (Corrective Action of +$30,742 CV) None for now. Variance is temporary. PM Assessment Agreed. Closed.	Thomas Markiewicz	31-May-2019

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WBS	BCWS	BCWP	ACWP	SV	CV	SPI	CPI	Explanation	Impact Analysis	Corrective Action	Updated by	Report Date
3.06.05.02	1,191,119	755,889	980,917	(435,230)	(225,028)	0.63	0.77	May 2019 (Explanation of -$225,028 CV) The CV is due to costs resulting from the time required to produce, approve and release the drawing package required for construction and sometimes react to changes in the HX design by other LSST subsystems and changes to the vacuum system. The labor variance is the same as for April whereas the increase in Non-Labor costs comes from vendor quotes coming at a more that tat budgeted (-60k in April to -101k in May)	May 2019 (Impact of -$225,028 CV) These are real costs. The incremental change from the previous month is -$62,101k.	May 2019 (Corrective Action of -$435,230 SV) A manufacturing purchase order for 3 of the 4 major subassemblies has been placed with a delivery date of July 24. The drawing package for the 4th large subassembly has been released and quotes are being collected. With the installation of the power feedthroughs in the cryostat in the 4th week of April, more effort and attention can be devoted to the UT. PM Assessment Feedthrough completed and resources focused on UT scope. Closed.	Thomas Markiewicz	31-May-2019
3.06.05.02	1,191,119	755,889	980,917	(435,230)	(225,028)	0.63	0.77	May 2019 (Explanation of -$435,230 SV) -$ 124,954 in non-labor is due to fact that procurement has not begun on most UT parts, especially the HX vacuum chambers (unchanged from March 2019) -$ 310,276 is the associated labor in designing, drawing, and procuring UT parts (was -$318k in April 2019)	May 2019 (Impact of -$435,230 SV) There is enough schedule float to handle these design and procurement delays. The incremental change from the previous month is +$10k.	May 2019 (Corrective Action of -$225,028 CV) EAC should be adjusted to reflect current understanding of costs PM Assessment EAC is within threshold. Closed.	Thomas Markiewicz	31-May-2019
3.07.01.03	1,843,440	1,646,801	1,933,568	(196,639)	(286,767)	0.89	0.85	May 2019 The cost variance is caused by a combination of * earlier standing army costs caused by delays of other subsystems which we are coupled to (Shutter, I&T, SR in particular) * less contributed labor than initially planned for, as documented in our 2016/17/18 EACs * requests for additional CCS functionality in the test stands, in particular the need to add additional safety features to test stands * more complexities in cryo/refrigeration and shutter subsystem than anticipated.	May 2019 The cost variance is still in line with our 2016/17/18 EAC estimates. As work is completed on the various subsystem mentioned above in the coming months we expect the cost variance to slowly decrease.	May 2019 We continue to work actively with all other camera subsystems to fine-tune our delivery schedule to meet their needs. Good progress is now being made on Shutter, Camera body and Rotator which are the main outstanding items, This is an ongoing effort and no additional corrective action is required at this time. PM Assessment Agreed. Closed.	Tony Johnson	31-May-2019
3.07.01.03	1,843,440	1,646,801	1,933,568	(196,639)	(286,767)	0.89	0.85	May 2019 The schedule variance is being caused mainly by waiting on other camera subsystems which are behind schedule. We are continuing to actively work with the shutter and camera body subsystem to complete the remaining work as quickly and efficiently as possible. The camera rotator which we have been waiting for is now available in IR2 and we have been making good progress in testing it. A full DAQ system is now available in IR2 which will enable us to complete work on full focal-plane readout by the summer (and we expect to get the DAQ v2.5 software in June)	May 2019 : Although the float on these items is small, we are actively working with the subsystems to try to avoid any additional delays, and to use subsystem manpower as efficiently as possible	None	Tony Johnson	31-May-2019

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WBS	BCWS	BCWP	ACWP	SV	CV	SPI	CPI	Explanation	Impact Analysis	Corrective Action	Updated by	Report Date
3.07.02.01	1,050,212	1,050,212	1,258,966	-	(208,754)	1.00	0.83	May 2019 A small positive cost variance of ~4.3K$ From April: A small positive const variance of ~1.6K$ From March: A small, positive cost variance of ~2.2K$ From February: An negative change of ~$8500 is reflected in this months balance. This is due to ongoing sustaining engineering incurred from the fallout of "fixing" the bug reported last month. That fix broke other parts of the DAQ system. The amount of additional labor was 68 hours, which @150$/hour = ~10K$. From January: A negative change of ~$8400 is reflected in this months balance. This is due to unexpected increase in support of the DAQ test-stands in the field. This support included labor to diagnose and fix discovered DAQ software bugs. Once fixed, labor was needed to deploy those fixes to the test-stands. The amount of labor was 73 hours, which @150$/hour = ~10K$. ($193K) Continued unexcepted labor and time to prepare and attend Director's status review. ($171K) - CV post EAC update unanticipated LOE encountered in support of in-field test-stands ($164K) - CV at last EAC Update CV is due to the following: The DAQ design had assumed usage of DIP switches on REBs. This turned out not be be supportable. Therefore, the configuration management of the raft mosaic became a DAQ responsibility. The additional effort was to be covered under sustaining engineering contingency. This effort would result in so-called DAQ V1.5. The labor for this effort has turned out to be considerably more then expected and accounts for ~$120K of the variance. While 1.5 is now complete we continued to run an additional $43K variance. LOE for this charge account	None.	May 2019 None necessary.	Michael Huffer	31-May-2019
3.08.02	2,886,693	2,775,731	2,927,147	(110,963)	(151,417)	0.96	0.95	May 2019 (CV = -$151k): The CV has many contributors including overruns on the BOT structure, overruns on the Cryostat Mock-up hardware, and unplanned servicing of the Raft Verification Test Stands. -$92k of this was captured in the Oct 2018 Comprehensive EAC. -$59k of this variance is related to recent overruns in the BOT development activities.	May 2019: There is little opportunity left in this account to recover from overruns and it may be necessary to add a portion of this to a future EAC for the account.	May 2019: No corrective action is needed (at this time). PM Assessment Agreed. Closed.	Tim Bond	31-May-2019
3.08.02	2,886,693	2,775,731	2,927,147	(110,963)	(151,417)	0.96	0.95	May 2019: -$111k variance can be attributed to late Camera verification analysis software development - behind schedule awaiting HW.	May 2019: Camera verification software development variance currently has no impact to Camera schedule.	May 2019: This variance will be carried until camera verification is completed - no corrective action is required. PM Assessment Agreed. Closed.	Tim Bond	31-May-2019

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WBS	BCWS	BCWP	ACWP	SV	CV	SPI	CPI	Explanation	Impact Analysis	Corrective Action	Updated by	Report Date
3.08.03	2,050,296	1,738,235	1,997,347	(312,061)	(259,112)	0.85	0.87	May 2019: (CV = $259k) +$335k past variance due to cost overruns associated with difficulties with the Raft Integration Gantry. - This variance has been substantiated in past EAC's -014, -021a, -029, and -031 -$79k of this overrun (= underrun) is associated with efficiencies in raft assembly and testing. - -79k of this was submitted in an FY19 comprehensive EAC update. +$87k of this overrun is associated with difficulties in Cryostat assembly. - 87k of this was submitted in a Mar 2019 EAC update.	May 2019: The past $343k cost overruns are real and they have been substantiated in past comprehensive EAC estimates. There may be opportunities to recover some of this loss in future work.	May 2019: No additional corrective action is required. PM Assessment Agreed. Closed.	Tim Bond	31-May-2019
3.08.03	2,050,296	1,738,235	1,997,347	(312,061)	(259,112)	0.85	0.87	May 2019: (SV = $312k) Total Schedule Variance can be broken up as follows: ~$79k - from delays in Cryostat assembly due to late Cryostat delivery. ~$73k – due to delayed Science Raft Acceptance Testing held up by Raft verification issues. ~$160k – due to Cryostat Handling Equipment development efforts delayed by staffing issues.	May 2019: Cryostat Assembly – Schedules impacts are significant as this is a component of the Camera critical path. Raft Acceptance Testing – Schedules impacts are significant due to the small amount of float that is available to the Camera critical path. Cryostat Handling Equipment – There is no impact to camera schedule due to large available float.	May 2019: Cryostat Assembly – New alternative schedules are being explored and implemented to minimize the impact of late deliverables to I&T. Raft Acceptance Testing – Use of additional TS7's for parallel verification of Science Rafts is being explored. Accelerated testing can occur as TS7-2 and TS7-3 become available. Cryostat Handling Equipment – No corrective action is required. PM Assessment Agreed. Forecast schedule has been reviewed closely and optimized to the project's best ability. Closed.	Tim Bond	31-May-2019
3.08.04	1,555,972	1,246,434	1,741,001	(309,538)	(494,567)	0.80	0.72	May 2019: (CV = $494k) Variance is due to cost overruns associated with the completion of the IR2 Clean Room. This includes finishing construction of the clean room and populating/outfitting the clean room. Recent increases in this variance (April/May) are due to overruns on the cost of the CIS structure. $278k of this was substantiated in the Comprehensive Nov 2016 EAC. $144k of this was substantiated in the Comprehensive Nov 2017 EAC. $90k of this was substantiated in the Comprehensive Nov 201 8 EAC	May 2019: These cost overruns are real and have been substantiated in past comprehensive EAC estimates.	May 2019: Additional I&T Staff will be allocated to accelerate these efforts as they become available. PM Assessment Agreed. This is part of the project wide prioritization of resources and has been approved by the project. Closed.	Tim Bond	31-May-2019
3.08.04	1,555,972	1,246,434	1,741,001	(309,538)	(494,567)	0.80	0.72	May 2019: (SV = $310k) $310k variance is attributed to the Camera Integration Stand. This was delayed due to lack of resources. As resources become available the variance is expected to improve.	May 2019: Camera Integration Stand delays currently have no impact on Camera schedule as total float is substantial.	May 2019: No further corrective action is required. PM Assessment Agreed. Closed.	Tim Bond	31-May-2019