***Title*:** QSU4 FY2019	***Author*:** Thisdell/ADs	***Date*:** 11/7/2019
		***Version*:** Draft

National Radio Astronomy Observatory

Quarterly Status Update (QSU) 4 FY2019

July - September 2019

PREPARED BY	ORGANIZATION	DATE
Thisdell/ADs	Director's Office	11/7/2019

APPROVALS (Name and Signature)		ORGANIZATION
Nicole Thisdell	Nicole Thisdell Digitally signed by Nicole Thisdell Date: 2019.11.13 11:48:47 -05'00'	NRAO
Tony Beasley	Digitally signed by Tony Beasley Date: 2019.11.13 11:56:18 -05'00'	NRAO
Dave Curren		AUI

NRAO Quarterly Status Update
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			Q1 Performance Assessment			Q2 Performance Assessment			Q3 Performance Assessment			Q4 Performance Assessment		
POP Milestone	**Milestone**	**Completion Date**	**Cost**	**Schedule**	**Scope**	**Cost**	**Schedule**	**Scope**	**Cost**	**Schedule**	**Scope**	**Cost**	**Schedule**	**Scope**
2.5	**NA ALMA Operations**		**Q1 Performance Assessment**											
	NAASC													
1	Create Position of Deputy Division Head within the NAASC	12/31/2018												
2	Finalize the NAASC Reorganization	12/31/2018												
3	ALMA Ambassador applications will be advertised to the community	12/31/2018												
4	Run and organize the ALMA Ambassadors program in Charlottesville	3/30/2019												
5	TORUS 2018: The Many Faces of AGN Obscuration meeting	12/31/2018												
6	Exploring our Cosmic Origins: New Results from the Atacama Large Millimeter/submillimeter Array	3/30/2019												
7	New Horizons in Planetary Systems	6/30/2019												
8	Topical meeting on data combination techniques and strategies	9/30/2019										Cancelled		
9	Cycle 7 Call for Proposal and user documentation and ALMA Science portal updates/edits	12/31/2018												
		3/30/2019												
10	Preparation of the ALMA Cycle 7.5 Call for Proposals	12/31/2018												
11	Instructional video on the subtleties of ALMA operations	3/30/2019										Cancelled		
12	Conduct an investigation into the apparent fall off in publication rate of NA ALMA users	12/31/2018												
		3/30/2019												
13	Present the results of the investigation	6/30/2019												
14	Pipeline initial requirements	12/31/2018												
15	Validate CASA 5.5/6.0	3/30/2019												
16	Pipeline final requirements	6/30/2019												
17	Test and make acceptance recommendation for ALMA Cycle 7 pipeline	9/30/2019												
18	NAASC staff will develop and implement the raw data pilot program	12/31/2018												
19	Venue for ALMA APRC7 finalized	12/31/2018												
20	Support APRC7 Meeting	6/30/2019												
21	P2G prepared and review all NA Phase 2 SBs	12/31/2018												
		3/30/2019												
22	ObsMode Cycle 8 planning, meeting and follow-up process in coordination with JAO	3/30/2019												
		6/30/2019							Cancelled					
		9/30/2019										Cancelled Q3		
23	Planning and coordination meetings in preparation for Cycle 7	6/30/2019												
		9/30/2019												
	Development													
24	FY2020 (Cycle 7) Call for Study Proposals	3/30/2019												
25	FY2020 (Cycle 7) Study Award Notifications	9/30/2019												
26	Band 6 Upgrade project Proposal	12/31/2018		Cancelled										
	Maintenance, Renewal, and Warranty Claims													
27	Begin cabin temp control project (all 25 antennas)	12/31/2018												
28	Finish cabin temp control project (all 25 antennas)	6/30/2019												
29	Deliver reworked FEHV 1 to JAO	12/31/2018												
30	Deliver FEHVs 2, 3, and 4 to JAO	9/30/2019												
	NRAO-Chile Office													
31	Renewal of office lease	12/31/2018												
32	Catering, cleaning and maintenance contract	3/30/2019												
		6/30/2019												
		9/30/2019												
33	Accounting tool Blackline	12/31/2018												

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POP Milestone	Milestone	Completion Date	Q1 Performance Assessment			Q2 Performance Assessment			Q3 Performance Assessment			Q4 Performance Assessment		
			Cost	Schedule	Scope	Cost	Schedule	Scope	Cost	Schedule	Scope	Cost	Schedule	Scope
33	Accounting tool Blackline	3/30/2019												
34	Inauguration of *Multicancha*	9/30/2019												
35	Survey and assessment of NA infrastructure	12/31/2018												
36	Study on provision of power to non-ALMA projects	12/31/2018												
		3/30/2019												
37	Introduction of new ETK	12/31/2018												
38	Streamlining of HRIS	12/31/2018												
		3/30/2019												
39	Lessons learned from 2018 collective bargaining	12/31/2018												
		3/30/2019												
		6/30/2019												
		9/30/2019												
40	Application of 2018 collective contract clauses	3/30/2019												
41	Envelope and strategy for 2020 collective bargaining	9/30/2019												
42	Sister Cities and Observatories: strengthening of STEAM	12/31/2018												
		3/30/2019												
		6/30/2019												
		9/30/2019												
43	Galileo Teachers Training Program: global meeting in Chile	12/31/2018												
		3/30/2019												
		6/30/2019												
44	Kick off role model series/campaign	12/31/2018												
		3/30/2019												
45	Hour of Code sessions (2)	12/31/2018												
		6/30/2019												
46	Organization of public meeting/seminar on D&I topic	6/30/2019												
47	Diversity and Inclusion section on OCA website	9/30/2019												
3.3	**New Mexico Operations**													
	Very Large Array													
	Operations													
1	Define VLA GO and SRO capabilities to be offered for semester 2019B	12/31/2018												
2	Define VLA GO and SRO capabilities to be offered for semester 2020A	6/30/2019												
3	Update VLA documentation to support 2019B Call for Proposals, perform proposal technical reviews	3/30/2019												
4	Update VLA documentation to support 2020A Call for Proposals, perform proposal technical reviews	9/30/2019												
5	Determine baselines and pointing for antennas moving into their C configuration locations	12/31/2018												
6	Determine baselines and pointing for antennas moving into their B configuration locations	3/30/2019												
7	Determine baselines and pointing for antennas moving into their BnA configuration locations	6/30/2019												
8	Determine baselines and pointing for antennas moving into their A configuration locations	9/30/2019												
9	Reconfigure from D to C array	12/31/2018												
10	Reconfigure from C to B Array	3/30/2019												
11	Reconfigure from B to BnA Array	9/30/2019												
12	Reconfigure from BnA to A Array	9/30/2019												
	Development													
13	*Realfast* operational for all supported observing modes	9/30/2019												
14	VLASS1.1 Single epoch continuum imaging complete	12/31/2018												
15	VLASS1.2 observing complete	6/30/2019												
16	VLASS1.2 QuickLook imaging complete	9/30/2019												
17	VLASS special session at winter AAS meeting	3/30/2019												

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			Q1 Performance Assessment			Q2 Performance Assessment			Q3 Performance Assessment			Q4 Performance Assessment		
POP Milestone	**Milestone**	**Completion Date**	**Cost**	**Schedule**	**Scope**	**Cost**	**Schedule**	**Scope**	**Cost**	**Schedule**	**Scope**	**Cost**	**Schedule**	**Scope**
18	VLASS science meeting	9/30/2019											Cancelled	
19	VLASS/CIRADA definition complete	12/31/2018												
	Maintenance and Renewal													
20	Perform five antenna overhauls during the year	9/30/2019												
21	Replace one antenna azimuth bearing during the year	9/30/2019												
22	Perform preventive maintenance on each of two transporters prior to array reconfiguration to B	12/31/2018												
23	Perform preventive maintenance on each of two transporters prior to array reconfiguration to A	6/30/2019												
24	Perform preventive maintenance on each of two transporters prior to array reconfiguration to D	9/30/2019											Cancelled	
25	Identify and replace 5000 aging or damaged cross-ties during the course of the year	9/30/2019												
26	Identify and replace five antenna intersections during the course of the year	9/30/2019												
27	Perform preventive maintenance on the next configuration VLA antenna transformers prior to array reconfiguration to B	12/31/2018												
28	Perform preventive maintenance on the next configuration VLA antenna transformers prior to array reconfiguration to A	6/30/2019												
29	Perform preventive maintenance on the next configuration VLA antenna transformers prior to array reconfiguration to D	9/30/2019											Cancelled	
30	Replace several site heavy vehicles	9/30/2019												
31	Replace Rail Crane	9/30/2019												
32	Purchase ACU upgrade components	9/30/2019												
33	Purchase automatic grease distributors	9/30/2019												
34	Replace VLA well pump controller	9/30/2019												
35	Purchase new site doors/windows	9/30/2019												
36	Purchase track maintenance materials	9/30/2019												
37	Purchase CNC Knee Mill	9/30/2019												
	Technical Upgrades and Enhancements													
38	L-band Solar upgrade, install five additional receivers (#26-#30) with full RF upgrade	9/30/2019												
39	Ku-band Solar upgrade, install three additional receivers (#19-#21) with 20 dB switched attenuators on outputs only, no Solar Tcals.	6/30/2019												
40	Ku-band Solar upgrade, install three additional receivers (#22 #24) with 20 dB switched attenuators on outputs only, no Solar Tcal	9/30/2019												
41	Install ACUs in three antennas, #11, 12, and 13	9/30/2019												
42	Install upgraded servo SCR cards in three antennas	9/30/2019												
43	Design and build PCB for refrigerator variable frequency drive	3/30/2019												
44	Upgrade the FE card cage firmware to V6.02 in 65 receivers	6/30/2019												
45	Frequency averaging promoted from SRO to GO	3/30/2019												
46	Phase-binned pulsar observing promoted from SRO to GO	3/30/2019												
47	Coherent-dedispersion pulsar observing promoted from RSRO to SRO	6/30/2019												
48	Wind prediction software requirements	12/31/2018												
49	Wind prediction implementation	6/30/2019												
50	Implementation of conditional Scheduling Blocks in OPT	3/30/2019												
51	RFI excision in WIDAR tested	9/30/2019												
	Very Long Baseline Array													
	Operations													
52	Define VLBA general and shared risk capabilities to be offered for semester 2019B	12/31/2018												
53	Define VLBA general and shared risk capabilities to be offered for semester 2020A	6/30/2019												
54	Update VLBA documentation to support 2019B Call for Proposals, perform proposal technical reviews	3/30/2019												
55	Update VLBA documentation to support 2020A Call for Proposals, perform proposal technical reviews	9/30/2019												
56	Transfer dynamic scheduling duties to VLBA data analysts	9/30/2019												
57	Retire MainSaver as maintenance tracking tool	6/30/2019												

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	Development													
58	Install Mark6 4 Gbps recording equipment at the 10 VLBA sites	3/30/2019												
59	Commission Mark6, 4 Gbps recording capability	6/30/2019												
	Maintenance and Renewal													
60	Major VLBA Maintenance Visit #1	6/30/2019												
61	Major VLBA Maintenance Visit #2	9/30/2019												
	Technical Upgrades and Enhancements													
62	Design, build, and test a VLBA site weather station replacement.	9/30/2019												
63	Build and install L404B synthesizers in one VLBA antenna.	3/30/2019												
64	Verify operation of L404B synthesizer	6/30/2019												
65	Install one E-Rack at a VLBA site	3/30/2019												
4.6	**Next Generation Very Large Array**													
	Astro2020 Preparations													
1	Conduct documentation reviews for ngVLA Reference Design	3/30/2019												
2	Receipt and review of final results of Costed Antenna Reference Design	12/31/2018												
3	Reference Design Packet ready for submission to Astro2020 process.	3/30/2019												
	Community Engagement													
4	Publication of findings for second round Community Studies	12/31/2018												
5	Formal Publication of ngVLA Science Book through ASP	12/31/2018												
6	Engage potential domestic and international partners	6/30/2019												
7	Host a Special Session at 2019 URSI National Radio Science Meeting	3/30/2019												
8	Host a special session at 2019 Winter AAS	3/30/2019												
9	Develop ngVLA flyover animation	12/31/2018												
10	Put together multi-messenger animation production team	6/30/2019												
11	Identify additional science case for animation	9/30/2019												
	Conceptual Design and Development													
12	Reference Observing Program	3/30/2019												
13	System Requirements	6/30/2019												
14	Requirements and Architecture Model	6/30/2019												
15	Preliminary Operations Plan	3/30/2019												
16	Preliminary Transition Plan	3/30/2019												
17	Preliminary Development Plan	6/30/2019												
18	Array Calibration Plan	9/30/2019												
19	Array Configuration	9/30/2019												
20	System Requirements and Architecture Review	9/30/2019												
21	Preliminary Sub-System Requirements	6/30/2019												
22	Antenna Optical Design	3/30/2019												
23	Antenna Mechanical Design	6/30/2019												
24	Correlator-Beamformer Design	9/30/2019												
25	Composite Antenna Structures PDR	12/31/2018												
26	Composite Antenna Structures Study Complete	3/30/2019												
28	Wide Angle Feed Tests	9/30/2019												
29	Wide Band Feed Designs	9/30/2019												
27	Wide Angle Feed Prototype	9/30/2019												
30	Integrated Receiver Development Prototypes	3/30/2019												
31	Integrated Receiver Development Tests	9/30/2019												
32	Water Vapor Radiometer Development	6/30/2019												
33	Time and Frequency Distribution	9/30/2019												
	Project Administration and Management													
34	Develop initial draft of Project Execution Plan	12/31/2018												

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			Cost	Schedule	Scope	Cost	Schedule	Scope	Cost	Schedule	Scope	Cost	Schedule	Scope
35	Review and update Project Execution Plan	9/30/2019												
36	Conduct a review of software solution options and determine best-fit solutions	12/31/2018												
37	Implement the selected software solutions	3/30/2019												
38	Internal Project Office review of the ngVLA cost model.	12/31/2018												
39	Prepare a risk-adjusted, fully costed and documented cost estimate for the reference design; formatted for Decadal Survey Astro2020 submission.	12/31/2018												
40	Prepare a lifecycle cost estimate in support of a proposal to the NSF AST Directorate for MREFC candidacy; formatted for NSF submission.	6/30/2019												
41	Provide final versions of systems engineering process planning and documentation	3/30/2019												
42	Finalization of Lifecycle Concepts	9/30/2019												
5.3	**Central Development Laboratory**													
	Repair, Maintenance, Production, and Support													
1	Build and test Band 1 amplifiers	12/31/2018												
		3/30/2019												
		6/30/2019												
		9/30/2019												
2	Build and test Band 1 Local Oscillators	12/31/2018												
		3/30/2019												
		6/30/2019												
		9/30/2019												
3	VLA/VLBA multi-chip module support	12/31/2018												
		3/30/2019												
		6/30/2019												
		9/30/2019												
4	CUP ASIC devices (prototype)	9/30/2019										Cancelled		
5	CUP Circuit card assemblies	6/30/2019										Cancelled		
	Research and Development													
6	Design Band 6v2 Nb/AlN/Nb SIS mixer	9/30/2019										Cancelled		
7	Evaluate upgraded balanced IF amplifiers	6/30/2019										Cancelled		
8	Wide flare angle horn prototype(s) for ngVLA	12/31/2018												
9	Ka-Band feed horns for VLBA	3/30/2019					Cancelled							
10	Design dichroic and tertiary reflectors for VLBA	6/30/2019								Cancelled				
		9/30/2019								Cancelled				
11	Design of the ngVLA Central Signal Processor	12/31/2018												
12	Test SADC prototype ASIC	6/30/2019												
13	Test W-band DSSM-DOMT receiver	6/30/2019												
14	Develop modular DSP platform	9/30/2019												
15	Advanced reflectionless filter implementations	6/30/2019												
6.7	**Science Support and Research**													
	Telescope Time Allocation													
1	CfP for Semester 2019B	3/30/2019												
2	SRP and Tech Review Process, Semester 2019B	3/30/2019												
3	CfP for Semester 2020A	9/30/2019												
4	SRP and Tech Review Process, Semester 2020A	9/30/2019												
5	TAC Meeting, Semester 2019A	12/31/2018												
6	TAC Meeting, Semester 2019B	6/30/2019												
7	Update SW Tools Requirements for TAC 2019A	12/31/2018												
8	Update SW Tools Requirements for PST 2019A	3/30/2019												
9	Update SW Tools Requirements for TAC 2019B	6/30/2019												
10	Update SW Requirements Tools for PST 2020A	9/30/2019												

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11	Update Documentation for CfP and Tools 2019B	3/30/2019												
12	Update Documentation for CfP and Tools 2020A	9/30/2019												
13	TTA SW Tool Suite Requirements	12/31/2018												
14	eXtra-Large Proposals	12/31/2018												
	Science Ready Data Products													
15	SRDP Operations Planning Complete	3/30/2019												
16	Begin Pilot SRDP Operations	6/30/2019												
17	Pilot SRDP Operations Complete	9/30/2019												
	Scientific User Support													
18	Community Day Event Program Finalized	6/30/2019												
19	NM Symposium	12/31/2018												
20	CASA Validation	3/30/2019												
21	CASA Guides	3/30/2019												
22	CASA Validation	6/30/2019												
23	CASA Guides	6/30/2019								Cancelled				
24	CASA Validation	9/30/2019												
25	CASA Guides	9/30/2019											Cancelled	
	Reference Services													
26	NRAO Papers requirements	12/31/2018								Cancelled				
27	NRAO Papers replacement plan	9/30/2019											Cancelled	
28	Development of U.S. Radio Astronomy	12/31/2018												
	Scientific Staff and Jansky Fellows													
29	SciStaff Performance Reviews Completed	12/31/2018												
30	SciStaff Promotions Reviews Completed	3/30/2019												
31	Post Tenure Reviews Completed	3/30/2019												
32	Jansky Lectureship Awarded	6/30/2019												
33	Jansky Fellows Selection Completed	12/31/2018												
34	Jansky Fellows Appointments Completed	3/30/2019												
	Student Programs													
35	Summer Student Selection and Offers	3/30/2019												
36	Student Observing Support Selection (VLA)	12/31/2018												
37	Student Observing Support Selection (VLA)	6/30/2019												
38	Student Observing Support Selection (ALMA)	9/30/2019												
39	Reber Predoc Selection	3/30/2019												
40	Reber Predoc Selection	9/30/2019												
7.5	**Data Management and Software**													
	SIS													
1	RHEL Configuration Control system	6/30/2019												
2	Oracle Virtual Machine installation	3/30/2019												
3	Upgrade of NGAS storage for VLA	3/30/2019												
4	Upgrade of NGAS storage for NAASC	9/30/2019												
5	Warm storage evaluation	6/30/2019												
6	Moab cluster scheduler optimization	12/31/2018												
7	CASA Memory performance	9/30/2019												
	ALMA Systems Software													
8	ALMA Cycle 7 release	3/30/2019												
9	ALMA Cycle 8 pre-release	9/30/2019												
10	SDM improvements	9/30/2019												
	VLA													
11	Support 2018B observing	3/30/2019												

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12	Support 2019A observing	9/30/2019												
13	Support 2019A commissioning	3/30/2019												
14	Support 2019B commissioning	9/30/2019												
15	Support Frequency averaging to GO	3/30/2019												
16	Support YUPPI-mode to SRO	6/30/2019												
17	Wind prediction in the OST	6/30/2019												
18	Conditional SBs in OST/OPT	3/30/2019												
19	Support testing RFI excision in WIDAR	9/30/2019												
	CASA													
20	CASA 5.5 release	3/30/2019												
21	CASA 6.0 release	6/30/2019												
22	CASA 5.6 release	9/30/2019												
23	MSv3 report	3/30/2019												
	CASA Pipeline													
24	Pipeline Cycle 6 release	12/31/2018												
25	Pipeline Cycle 7 pre-release	9/30/2019												
	SSA													
26	New Archive default	9/30/2019												
27	PST/OPT Proposal/Observing Update	12/31/2018												
28	PST/OPT Proposal/Observing Update	6/30/2019												
29	PHT TAC update	3/30/2019												
30	PHT TAC update	9/30/2019												
31	YUPPI-mode supported in OPT	6/30/2019												
	SRDP													
32	SRDP initial release	6/30/2019												
	Testing													
33	CASA 6 test framework	6/30/2019												
34	CASA regression tests	9/30/2019												
	Algorithm Research and Development													
35	Joint single dish-interferometric Imaging	6/30/2019												
36	Full Mueller Imaging	6/30/2019												
37	AW-Project Imaging	6/30/2019												
8.5	**Program Management Department**													
	Headquarters													
1	HQ PM/SE Project Leadership	12/31/2018												
		3/30/2019												
		6/30/2019												
		9/30/2019												
2	HQ Proposal Development	12/31/2018												
		3/30/2019												
		6/30/2019												
		9/30/2019												
3	HQ Documentation Support	12/31/2018												
		3/30/2019												
		6/30/2019												
		9/30/2019												
4	HQ Continuing Education	12/31/2018												
		6/30/2019												
5	Program Management Software Requirements Collection and Analysis	12/31/2018												
6	Program Management Software Solution Implementation	6/30/2019												

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7	Multicancha Mass Concrete Works Complete	12/31/2018												
8	Multicancha Beams Erection Complete	12/31/2018												
9	Multicancha Membrane Installation Complete	3/30/2019												
10	Multicancha Sport Flooring Installation Complete	3/30/2019												
11	Multicancha Construction Complete	9/30/2019												
12	SRDP Pilot Operations Readiness Review	6/30/2019												
13	SRDP Wave 1 Review	9/30/2019												
	New Mexico Operations													
14	NM PM/SE Project Leadership	12/31/2018												
		3/30/2019												
		6/30/2019												
		9/30/2019												
15	NM Proposal Development	12/31/2018												
		3/30/2019												
		6/30/2019												
		9/30/2019												
16	NM Documentation Support	12/31/2018												
		3/30/2019												
		6/30/2019												
		9/30/2019												
17	NM Continuing Education	12/31/2018												
		3/30/2019												
		6/30/2019												
		9/30/2019										Cancelled		
18	CIRADA VLASS EDPs Annual Financial and Progress Report	6/30/2019												
19	VLA Track Maintenance - All Procurements Complete	9/30/2019												
20	VLBA Fiber Final Service Analysis Report	9/30/2019												
21	VLBA St. Croix Repairs - Develop RfP for Steel Repairs and Antenna Painting	12/31/2018												
22	VLBA St. Croix Repairs - Issue Contracts for Steel Repairs and Antenna Painting	3/30/2019												
23	Manage and track Astro2020 Decadal Survey submission package content for ngVLA	3/30/2019												
24	Manage and track ngVLA MREFC proposal package content	9/30/2019												
	Central Development Lab													
25	CDL PM/SE Project Leadership	12/31/2018												
		3/30/2019												
		6/30/2019												
		9/30/2019												
26	CDL Proposal Development	12/31/2018												
		3/30/2019												
		6/30/2019												
		9/30/2019												
27	CDL Documentation Support	12/31/2018												
		3/30/2019												
		6/30/2019												
		9/30/2019												
28	CDL Continuing Education	3/30/2019												
		9/30/2019												
29	ALMA Band 1 LNA Quarterly Report	12/31/2018												
		3/30/2019												
		6/30/2019												
		9/30/2019												

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			Q1 Performance Assessment			Q2 Performance Assessment			Q3 Performance Assessment			Q4 Performance Assessment		
POP Milestone	**Milestone**	**Completion Date**	**Cost**	**Schedule**	**Scope**	**Cost**	**Schedule**	**Scope**	**Cost**	**Schedule**	**Scope**	**Cost**	**Schedule**	**Scope**
30	CSA-J Annual Report	6/30/2019												
	ALMA Development													
31	ALMA Correlator Upgrade ASIC Vendor Contract Award	12/31/2018												
32	ALMA Correlator Upgrade Critical Design Review	6/30/2019										Cancelled		
33	ALMA Band 6v2 Receiver Upgrade Project Kickoff	12/31/2018				Cancelled								
9.5	**Education and Public Outreach**													
	News and Public Information													
1	Full editorial guidelines for new news homepage	12/31/2018												
		3/30/2019												
		6/30/2019												
		9/30/2019												
2	Consensus from ngVLA/VLASS teams on topic for AAS press reception	3/30/2019												
	Multimedia Engagement													
3	Plan for workflow for VLASS Quick Look	12/31/2018												
4	Research and development for VLASS image inclusion across various platforms	3/30/2019												
5	Developing and testing first Data2Dome feed	12/31/2018												
6	Develop additional Data2Dome feeds	6/30/2019												
7	Research and development for best practices for animation asset management	9/30/2019												
8	Pipeline research and development	3/30/2019												
9	Develop ngVLA flyover animation and science case visuals	12/31/2018												
10	Establish test site for launch of new NSF logo guidelines	9/30/2019												
11	Create VLBA webpage	12/31/2018												
	STEAM													
12	San Pedro participants travel to NM	12/31/2018												
13	NM participants travel to San Pedro	3/30/2019												
14	Revised programming plan	3/30/2019												
15	Recruiting of participants FY2019	6/30/2019							Cancelled					
16	Survey of Charlottesville and Socorro for community needs	12/31/2018												
17	Recommendation from staff survey report 2017	9/30/2019												
18	Develop and implementation of Amazing Cart of Science	9/30/2019												
10.4	**Computing and Information Services**													
	Observatory-Wide Support													
1	Completion of Windows 10 rollout	12/31/2018												
2	Mac OS upgrade	3/30/2019												
3	RHEL 7 image management evaluation	6/30/2019												
4	Virtual Machine management evaluation	3/30/2019												
5	Server consolidation into VMs	9/30/2019												
6	Internal vulnerability scanning tool evaluation	6/30/2019												
7	Execution of internal vulnerability scan	9/30/2019												
8	Cyber security training	6/30/2019												
9	Cyber security program review	3/30/2019												
10	Two-factor authentication selection	9/30/2019												
11	Upgrade of Plone and Wiki services	6/30/2019												
	Site Specific Facilities Infrastructure													
12	Fiber infrastructure to VLBA sites	9/30/2019												
13	System area network upgrade for NAASC	3/30/2019												
14	Replacement of filer storage system in NM	12/31/2018												
	Maintenance and Renewal													
15	Evaluation of video system replacement	3/30/2019												
16	MS campus agreement renewed	6/30/2019												

NRAO Quarterly Status Update
July - October 2019
QSU4 FY2019

			Q1 Performance Assessment			Q2 Performance Assessment			Q3 Performance Assessment			Q4 Performance Assessment		
POP Milestone	**Milestone**	**Completion Date**	**Cost**	**Schedule**	**Scope**	**Cost**	**Schedule**	**Scope**	**Cost**	**Schedule**	**Scope**	**Cost**	**Schedule**	**Scope**
11.3	**Office of Diversity and Inclusion**													
	Local and National Programs													
1	Diversity Council Meeting and Diversity and Cultural Awareness (DCA) activities	12/31/2018												
		3/30/2019												
		6/30/2019												
		9/30/2019												
2	NAC and LSAMP – Recruitment & Summer Program Initiation	3/30/2019												
		6/30/2019												
3	RAMP-UP	12/31/2018		Cancelled										
4	Summer Programs Completed	9/30/2019												
5	NAC Annual Workshop	9/30/2019												
	International Partnerships													
6	ODI Chile Undergraduate Recruiting	12/31/2018												
7	ODI Chile Undergrad Research Experience Completed	3/30/2019												
8	NINE Program	6/30/2019												
		9/30/2019												
12.7	**Human Resources**													
	Training and Development													
1	Observatory Leadership Cohort Pilot	12/31/2018												
		3/30/2019												
		6/30/2019												
		9/30/2019												
2	Mid-Career Management Training	3/30/2019												
	Compensation													
3	JDE Comp Management Module Implementation	12/31/2018												
4	Total Rewards Benchmark Study Debrief	12/31/2018												
5	Benefits Strategy Workshop	6/30/2019												
6	Variable Pay Plan and Performance Bonus Structure Design	9/30/2019												
	Benefits													
7	New Medical Carrier Implementation.	12/31/2018												
8	DBA Audit	6/30/2019												
	Recruitment Employment													
9	Enhanced branding on LinkedIn, Glassdoor, and Stack Overflow	3/30/2019												
	Human Resources													
10	Employee Climate Survey	3/30/2019												
11	Research and evaluate regulations and policy implications related to medical marijuana	9/30/2019												
13.2	**Science Communications**													
1	Redesign science community exhibits	12/31/2018												
2	Update Research Facilities brochure	3/30/2019												
3	Submit AAAS science symposium proposal	6/30/2019												
4	Complete NRAO Annual Report	9/30/2019												
14.6	**Administration**													
	CAP													
1	Review the utilization of the small business plan and tracking resources over the first year of implementation.	9/30/2019												
2	Install Recordkeeping Software	12/31/2018												
	ESS													
3	Download existing ES&S data to Recordkeeping system	3/30/2019												
4	Hire EMS Specialist for VLA	12/31/2018												
	TTO													

NRAO Quarterly Status Update
July - October 2019
QSU4 FY2019

			Q1 Performance Assessment			Q2 Performance Assessment			Q3 Performance Assessment			Q4 Performance Assessment		
POP Milestone	**Milestone**	**Completion Date**	**Cost**	**Schedule**	**Scope**	**Cost**	**Schedule**	**Scope**	**Cost**	**Schedule**	**Scope**	**Cost**	**Schedule**	**Scope**
5	Plan workshop	9/30/2019												
6	Participate in winter I-Corps cohort	3/30/2019												
15.1	**Budget**													
1	Worker's Comp Vendor Visit to GBO	12/31/2018												
2	Position Control Definition	12/31/2018												
3	Position Control V1.0	6/30/2019												
4	Implement FY2019 Budget	12/31/2018												
5	NSF Spring Budget Meeting	3/30/2019												
6	FY2020 Budget Process	6/30/2019												
7	FY2020 Budget Presentation	9/30/2019												
8	FY2019 ICC Final Rate Submission	3/30/2019												
9	FY2020 ICC Preliminary Rate Submission	9/30/2019												
16.3	**Spectrum Management**													
1	CPM, Geneva	3/30/2019												
2	WP 7D, Geneva	3/30/2019												
3	WP 1A, Geneva	6/30/2019												
4	CORF, Washington DC	6/30/2019												
17.2	**Director's Office**													
	ALMA													
1	ALMA Board Meeting	12/31/2018												
		6/30/2019												
2	ALMA Director's Council	3/30/2019												
		9/30/2019												
	Corporate Meetings													
3	AUI Board of Trustee Meeting	12/31/2018												
		6/30/2019												
4	AUI Executive Committee Meeting	12/31/2018												
		3/30/2019												
		6/30/2019												
		9/30/2019												
5	AUI Visiting Committee	6/30/2019												
	Science Community													
6	Appoint new Users Committee Members	12/31/2018												
7	Users Committee Meeting	6/30/2019												
	Management Reviews													
8	NSF Annual Program Review	12/31/2018												
9	All Hands Meeting	3/30/2019												
		9/30/2019												

Color code: Cost/Schedule/Scope Cells

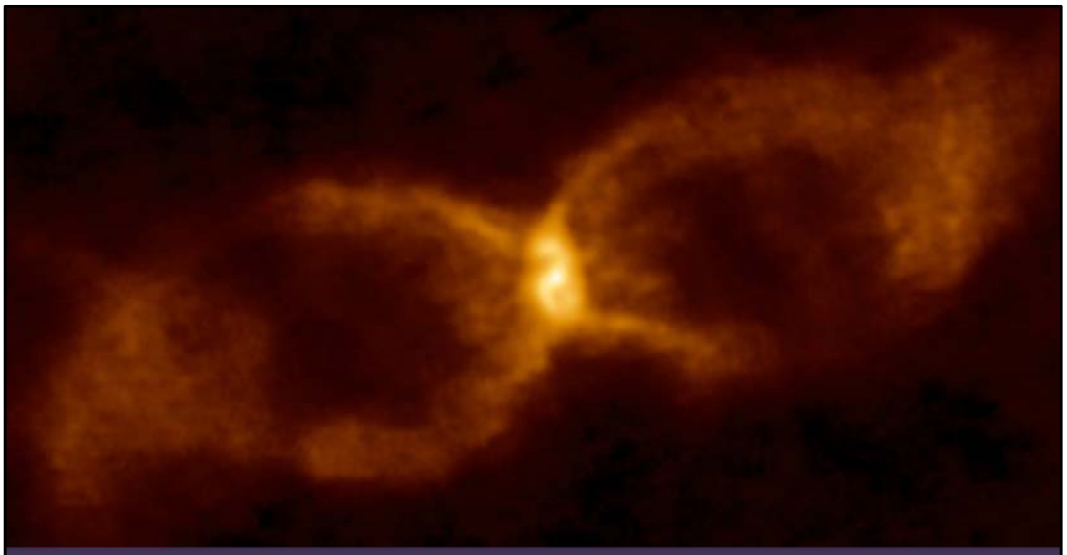
Blue - early

Green - on track

Yellow - expected to miss an upcoming milestone and/or not meet scope, and/or be underspent or overspent on

Red - not completed by due date and/or overspent on budget, and/or unable to perform to the scope

Grey - completed



QSU4 FY2019

July – October 2019

FY2019 Milestones - Final Scorecard

Milestone Progress	Annual POP Score Card	Previous Years
Total Q4 2019 milestone deadlines: 125	Total number of 2019 POP Milestones: 364	Total number of 2018 POP Milestones: 352
Total completed on time: 98	364 milestones with 448 quarterly deadlines	Percent completed on time: 82.6%
Percent completed on time: 78.4%		Percent completed in the year: 92.5%
	Total 2019 quarterly deadlines completed on time: 366	Percent postponed to next year: 6.2%
Total Q3 2019 milestone deadlines: 106	Percent completed on time: 81.7%	Percent cancelled: 2%
Total completed on time: 90		
Percent completed on time: 85%	Total completed in FY2019: 401	Total number of 2017 POP Milestones: 303
	Percent completed in the year: 89.5%	Percent completed on time: 82.84%
Total Q2 2019 milestone deadlines: 111		Percent completed in the year: 89.11%
Total completed on time: 89	Total moved to next year: 23	Percent postponed to next year: 5.94%
Percent completed on time: 80.2%	Percent postponed to next year: 5.1%	Percent cancelled: 4.62%
	FY2018 milestones outstanding: 4	
Total Q1 2019 milestone deadlines: 106		Total number of 2016 POP Milestones: 311
Total completed on time: 91	Total 2019 milestones cancelled: 24	Percent completed on time: 85.21%
Percent completed on time: 85.6%	Percent of 2019 milestones cancelled: 5.3%	Percent completed in the year: 91.32%
		Percent postponed to next year: 3.86%
		Percent cancelled: 4.82%

POP MILESTONE # 2.5.8

NAASC

Topical meeting on data combination techniques and strategies

COST:

Labor Actuals	Expected
$	$
Material Actuals	**Expected**
$	$
Travel Actuals	**Expected**
$	$

SCOPE:

Cancelled. Europe held a similar themed meeting in Q3 of FY2019. Several NRAO staff were included in that meeting and brought back several actions and follow-on discussions to be had in NA. Discussions continue into FY2020 and a more topical workshop is proposed for the future.

SCHEDULE:

Milestone	Schedule	Target
1. Topical meeting on data combination techniques and strategies	09/30/2019	Cancelled

RISK & MITIGATION:

Risk	Mitigation
1. Low	1. Topical workshop in FY2020

3 QSU4 FY2019

COST: No impact.

SCOPE: No impact.

SCHEDULE: This milestone is cancelled. Europe held a similar themed meeting in Q3 of FY2019. Several NRAO staff were included in that meeting and brought back several actions and follow-on discussions to be had in NA. We will continue these discussions into FY2020 and propose a more topical workshop at some point in the future.

RISK & MITIGATION: Risk is low and there is no immediate impact to any ALMA operations.

POP MILESTONE # 2.5.29

Maintenance, Renewal, and Warranty Claims

Deliver reworked FEHV 1 to JAO

Cost
Schedule
Scope

COST:

Labor Actuals	Expected
$0	$0
Material Actuals	**Expected**
$0	$0
Travel Actuals	**Expected**
$0	$0

SCOPE:

Execute FEHV part mass reduction changes: reassemble Units; verify and test assembled Units; conduct delta-PAS; and deliver Unit #1 to ALMA JAO.

SCHEDULE:

Milestone	Schedule	Target
1. Deliver reworked FEHV 1 to JAO	12/31/2018	11/22/2019

RISK & MITIGATION:

Risk	Mitigation
1. Cannot complete this milestone in Q1 FY2019	1. Work with Contractor to resolve FEHV scheduling issues

4 QSU4 FY2019

COST: No impact.

SCOPE: No change in scope; delivered FEHV to incorporate welding improvements and mass reductions.

SCHEDULE: Recall that after the re-assembled Unit #1 satisfied the FEHV Mass Limit, a joint decision was made to retain Unit #1 in Valdivia to act as a "display template" during the reassembly of Units #2, #3, and #4. Continuing lift jack pressure leakage issues prevented planned delivery of all four units by 30 September; these leakage issues are addressed via the POP Milestone #2.5.29 QSU4 discussion. October travel was rescheduled due to situation in Chile. Target Date for final PAS and delivery of the Units to JAO is 22 November.

RISK & MITIGATION: Until the installations are completed, observationally verified, and all units are working reliably, risk will remain. This risk is primarily borne by the vendor, and is being mitigated by close observational and engineering verification of the work.

POP MILESTONE # 2.5.30

Maintenance, Renewal, and Warranty Claims
Deliver FEHVs 2, 3, and 4 to JAO

Cost
Schedule
Scope

COST:

Labor Actuals	Expected
$0	$0
Material Actuals	**Expected**
$0	$0
Travel Actuals	**Expected**
$0	$0

SCOPE:

Execute FEHV Part mass reduction changes; reassemble Units; verify and test assembled Units; conduct delta-PAS; and deliver Unit #1 to ALMA JAO.

SCHEDULE:

Milestone	Schedule	Target
1. Deliver reworked FEHV 1 to JAO	12/31/2018	11/22/2019

RISK & MITIGATION:

Risk	Mitigation
1. Cannot complete this milestone in Q1 FY2019	1. Work with Contractor to resolve FEHV scheduling issues

5 QSU4 FY2019

COST: No impact.

SCOPE: No change in scope; delivered FEHV to incorporate welding improvements and mass reductions.

SCHEDULE: Despite corrective actions for a pressure leak in the lifting jack on Unit #4 identified in July, Unit #4 as well as Unit #3 were unable to comply with the Minimum Vertical Rate of Movement requirement (<5mm/hr) during the Delta-PAI conducted for Units #2, #3, and #4 in Valdivia, Chile, on 26 August 2019. However, the three units received Acceptance for the PAI contingent on the lift issue along with a few cleanliness items being resolved prior to delivery to the OSF. The Contractor in Valdivia conducted extensive corrective action activities on both faulty lift jack assemblies with the leak issues finally being corrected on 03 October. Arrangements have now been made for shipping all four FEHV Units to site with final PAS Reviews for acceptance and hand-over of the Units. October travel was delayed; now scheduled for November 22.

RISK & MITIGATION: Until the installations are completed, observationally verified, and all units are working reliably, risk will remain. This risk is primarily borne by the vendor, and is being mitigated by close observational and engineering verification of the work.

POP MILESTONE # 2.5.34

NRAO-Chile Office

Inauguration of multicancha

Cost
Schedule
Scope

COST:

Labor Actuals	Expected
$	$
Material Actuals	**Expected**
$	$
Travel Actuals	**Expected**
$	$

SCOPE:

The multicancha project is delayed, so the inauguration of the facility has also been postponed. The final acceptance process slipped to mid-April. Considering past contractor performance, mid-May would be realistic as a new target date for inauguration, but may conflict with collective bargaining.

SCHEDULE:

Milestone	Schedule	Target
1. Inauguration	9/30/2019	5/15/2020 or 6/15/2020

RISK & MITIGATION:

Risk	Mitigation
1. Falling short of staff expectations as collective bargaining process approaches.	1. Contract addendum to help the contractor finish the project. Communications to manage staff expectations.

6 QSU4 FY2019

COST: Rescheduling the inauguration ceremony does not involve additional cost.

SCOPE: Scope is not affected by rescheduling.

SCHEDULE: A construction end of February 15th, plus 60 days for JAO acceptance, means that the facility will not be delivered before mid-April. Considering past contractor performance, a month's margin seems appropriate, bringing the new date for inauguration to mid-May. However, this timing may conflict with collective bargaining. As the project advances and we have a precise idea of the completion date, we will define the exact date (perhaps mid-June).

RISK & MITIGATION: The main risk of not completing this project on time, and inaugurating the facility with significant staff engagement, is falling short of expectations. The mitigation in place is a contract addendum that includes bonuses for performance. In addition, once we have clarity about completion dates we will communicate to staff in order to manage expectations.

POP MILESTONE # 3.3.14

Cost
Schedule
Scope

NM Operations (VLASS)

VLASS 1.1 Single Epoch continuum imaging complete

COST:

Labor Actuals	Expected
$	$
Material Actuals	**Expected**
$	$
Travel Actuals	**Expected**
$	$

SCOPE:

The original milestone called for delivery of high quality Single Epoch wideband Stokes I continuum images for VLASS1.1.A technical problem with the 1.1 data was discovered and a means of correction must be developed prior to start of imaging. The scope of this milestone has been modified to cover development for VLASS1.1 corrections and start of SE continuum imaging for VLASS1.2 instead.

SCHEDULE:

Milestone	Schedule	Target
1. Begin VLASS1.2 SE continuum imaging	12/31/2018 (original scope)	11/30/2019

RISK & MITIGATION:

Risk	Mitigation
1. Compute resources for SE Imaging not fully quantified	1. Prioritize targets for imaging, optimize job processing, investigate additional resources, extend schedule

7 QSU4 FY2019

COST: Current tests of algorithms being developed indicate additional compute resources are needed to support VLASS SE imaging. Outsourced processing is under investigation by the DMS SCG group, with High Throughput Condor (HTCondor) at the Univ. of Wisc. as the most promising and cost effective way forward.

SCOPE: VLASS1.1 data reflects pointing errors with 2/3 of the VLA antennas, discovered after the FY2019 Program Operating Plan was written. Pointing corrections were made prior to observing under Epoch 1.2, therefore imaging will proceed for the 1.2 data. A means of correcting 1.1 data must be developed before SE imaging for VLASS1.1 can begin. W-term corrections (corrections for direction-dependent correlation geometry errors) are also needed to provide accurate source positions, flux densities, and spectral indices for SE images; these algorithms require significantly larger compute resources than the Quick Look images. Given these issues, the scope of this milestone was modified in Q1 to enable development of the data correction algorithms and methods for managing external computing resources, through to the start of SE continuum imaging. The VLASS1.1 data correction algorithms developed so far are too compute-intensive to be practical, so the scope of this milestone is now further modified to start SE continuum imaging for VLASS1.2 instead.

SCHEDULE: An imaging algorithm suitable for processing VLASS1.2 is now available in CASA and has been integrated with the VLASS Pipeline. Validation testing is currently underway, once validated Single Epoch imaging of VLASS 1.2 will commence. Further algorithm optimization needed for VLASS1.1 is on hold, pending evaluation of effort and resources required to produce VLASS 1.2 images.

RISK & MITIGATION: Compute requirements for SE imaging algorithms limit how much of the sky can be imaged using NRAO resources. This problem is being mitigated by prioritizing areas of sky to be imaged first, optimizing job processing, investigating the use of external compute resources, and by extending the overall delivery schedule of VLASS images to the community.

POP MILESTONE # 3.3.18

NM Operations (VLASS)
VLASS Science Meeting

COST:

Labor Actuals	Expected
$ N/C	$
Material Actuals	**Expected**
$ N/C	$
Travel Actuals	**Expected**
$ N/C	$

SCOPE:

Cancelled. This milestone was to convene a VLASS Science meeting to present high quality Single Epoch images. Due to issues described in the slide for Milestone 3.3.14 (Q4 FY2019) SE imaging results are not yet available

Recommend to revisit community engagement at a later time when the generation of the Single Epoch images is further advanced.

SCHEDULE:

Milestone	Schedule	Target
1. VLASS Science Meeting	12/31/2018 (original scope)	

RISK & MITIGATION:

Risk	Mitigation
1. Delayed community engagement may result in weak publication from Epoch 1.	1. Increase awareness of VLASS within user community

8 QSU4 FY2019

COST: Cost is deferred until community engagement is revisited.

SCOPE: The purpose of this meeting was to support the broader project objective of community engagement by meeting with the community when high fidelity images were available, thus building community interest in the survey. Recommend to cancel this milestone for reasons stated in the slide.

SCHEDULE:
TBD, Community engagement will be revisited following successful production of SE Images.

RISK & MITIGATION:
1) Delayed community engagement may result in weak publication from Epoch 1. Mitigation: Increase awareness of progress and status of VLASS through conference presentations and publishing opportunities

POP MILESTONE # 3.3.24

NM Operations

Perform preventative maintenance on each of two transporters prior to array reconfiguration to D

COST:

Labor Actuals	Expected
$	$
Material Actuals	**Expected**
$	$
Travel Actuals	**Expected**
$	$

SCOPE:

Cancelled. The date of the reconfiguration was modified after the electrical infrastructure upgrade work in 2018, and the preventative maintenance on the transporters ahead of D config is now covered by a milestone in the FY2020 POP.

SCHEDULE:

Milestone	Schedule	Target
1. Perform preventative maintenance on transporters	9/30/2019	10/14/2019

RISK & MITIGATION:

Risk	Mitigation
1. None	1. None

9 QSU4 FY2019

COST: No impact.

SCOPE: No impact.

SCHEDULE: This milestone is cancelled because it has been replaced by milestone #3.3.19 in FY2020. The preventive maintenance was re-scheduled to match the new array reconfiguration date (modified after the longer-than-anticipated shutdown for the electrical infrastructure update in FY2018) and will now take place in October 2019.

RISK & MITIGATION: There is no risk associated with this schedule delay.

POP MILESTONE # 3.3.29

NM Operations

Perform preventative maintenance on the next configuration EVLA antenna transformers prior to array reconfiguration to D

COST:

Labor Actuals	Expected
$	$
Material Actuals	**Expected**
$	$
Travel Actuals	**Expected**
$	$

SCOPE:

Cancelled. The date of the reconfiguration was modified after the electrical infrastructure upgrade work in 2018, and the preventative maintenance on the transformers ahead of D config is now covered by a milestone in the FY2020 POP.

SCHEDULE:

Milestone	Schedule	Target
1. Perform preventative maintenance on transformers	9/30/2019	10/8/2019

RISK & MITIGATION:

Risk	Mitigation
1. None	1. None needed

10 QSU4 FY2019

COST: No impact.

SCOPE: No impact.

SCHEDULE: This milestone is cancelled because it has been replaced by milestone #3.3.25 in FY2020. The preventive maintenance was re-scheduled to match the new array reconfiguration date (modified after the longer-than-anticipated shutdown for the electrical infrastructure update in FY2018) and will now take place in October 2019.

RISK & MITIGATION: There is no risk associated with this schedule delay.

POP MILESTONE # 3.3.41

NM Operations

Install replacement ACUs #11, 12, 13

Cost
Schedule
Scope

COST:

Labor Actuals	Expected

There are no changes in budget.

SCOPE:

Installation of custom Antenna Control Unit on three VLA antennas during their planned overhauls. There is no change to the scope.

SCHEDULE:

Milestone	Schedule	Target
1. Installation of 3rd ACU	8/30/2019	12/13/2019
2. Installation of 2nd ACU	7/15/2019	8/15/2019
3. Installation of 1st ACU	4/30/2019	4/29/2019

RISK & MITIGATION:

Risk	Mitigation
1. Failure of obsolete ACU prior to replacement	1. Monitoring of positioning performance and swap with spare components of older ACU if needed.

11 QSU4 FY2019

COST: No change. All items needed have been built and are ready for installation.

SCOPE: No impact.

SCHEDULE: Due to a change in the overhaul sequence, the third antenna that is due for a new ACU was not able to move into the antenna barn in time for this milestone's completion. The overhaul schedule was changed to include unplanned maintenance on a separate antenna's Focus Rotation Mount.

RISK & MITIGATION: The eleventh and twelfth antennas have had replacement ACUs installed. With this many ACUs replaced, a stockpile of components for the older system has enough stock to handle corrective maintenance should a part fail. Performance of that system will be monitored closely until it arrives in the antenna barn for the overhaul in December 2019.

POP MILESTONE # 3.3.42

Cost
Schedule
Scope

NM Operations

Install upgraded SCR cards in three VLA antennas

COST:

Labor Actuals	Expected

There are no changes in budget.

SCOPE:

Installation of new Silicon Controlled Rectifier (SCR) cards on three VLA antennas during their planned overhauls. These are replacing older units and are used to provide the proper voltage to move antenna motors. There is no change to the scope.

SCHEDULE:

Milestone	Schedule	Target
1. Installation of 3rd SCR	8/30/2019	12/13/2019
2. Installation of 2nd SCR	7/15/2019	8/15/2019
3. Installation of 1st SCR	4/30/2019	4/29/2019

RISK & MITIGATION:

Risk	Mitigation
1. Failure of SCR card	1. Monitoring of drive voltage for performance issues that may require advance replacement.

12 QSU4 FY2019

COST: No change. All cards are tested and ready for installation.

SCOPE: No impact.

SCHEDULE: Due to a change in the overhaul sequence, the third antenna that is due for new SCR cards was not able to move into the antenna barn in time for this milestone's completion. The overhaul schedule was changed to include unplanned maintenance on a separate antenna's Focus Rotation Mount.

RISK & MITIGATION: The 11th and 12th antennas have had replacement SCR cards installed. Performance of the system on the 13th antenna will be monitored closely until it arrives in the antenna barn for the overhaul in December 2019.

POP MILESTONE # 3.3.60

NM Operations

Major VLBA Maintenance Visit #1

Cost
Schedule
Scope

COST:

Labor Actuals	Expected

There are no changes in budget.

SCOPE:

Major maintenance visit to Los Alamos VLBA site for multiple preventive maintenance activities that require additional staff. There is no change to the scope.

SCHEDULE:

Milestone	Schedule	Target
1. Completion of maintenance visit	6/30/2019	2/3/2020

RISK & MITIGATION:

Risk	Mitigation
1. Azimuth 2 wheel assembly failure	1. Routine monitoring of assembly performance and lubrication quality. Send separate team for assembly swap if needed.

13 QSU4 FY2019

COST: No impact.

SCOPE: No change. Visit includes a preventive replacement of the azimuth two-wheel assembly.

SCHEDULE: Because of major resource conflicts due to the St. Croix repair project and the need to visit Mauna Kea twice during FY2019, staff and equipment were unavailable to support this trip. The Tiger Team visit is now scheduled for Q2 FY2020, at which point Los Alamos will receive a major preventive maintenance visit by staff from the Electronics and Engineering Services divisions.

RISK & MITIGATION: Due to the planned replacement of the wheel assembly being delayed, its performance and inspection of grease for signs of a failure are being watched closely. If signs of an impending failure are seen, antenna mechanics and engineers responsible for the assembly swap can be sent earlier than the main visit. There are currently no signs this is needed, despite this being the oldest remaining wheel assembly in the VLBA.

POP MILESTONE # 4.6.20

ngVLA

System Requirements & Architecture Review

Cost
Schedule
Scope

COST:

Labor Actuals	Expected
$	$
Material Actuals	**Expected**
$	$
Travel Actuals	**Expected**
$	$

SCOPE:

An external system-level requirements and architecture review will be conducted by the end of Q4 FY2019. The review will ensure an appropriate level of completeness in the requirements, and architectural coherence, prior to competing sub-system conceptual design down-selections.

SCHEDULE:

Milestone	Schedule	Target
1. Requirements & Architecture Review	9/30/2019	3/30/2020

RISK & MITIGATION:

Risk	Mitigation
1. Incomplete definition of subsystem requirements	1. Complete the review

14 QSU4 FY2019

COST: No impact.

SCOPE: No impact.

SCHEDULE: A Stakeholders Requirements Review was held in Socorro on September 26, partially fulfilling the original intent of this milestone. The review was chaired by Michael Rupen (NRC) and Melissa Soriano (JPL). The committee noted the high quality of the documents they reviewed, and provided useful feedback on the documents in the form of Review Item Discrepancies (RIDs). The RIDs are being addressed, and the review was successfully concluded. Other system requirements and the ngVLA architecture need to be reviewed in a separate undertaking in Q2 FY2020. The design and development effort has slowed in comparison to what was originally scheduled, because the funding for it is lower than anticipated.

RISK & MITIGATION: The high level requirements and architecture need to be reviewed for completeness and overall coherence so that the requirements for subsystems are in turn complete. By not conducting this review, the requirements definition for a subsystem could be incomplete, leading to an incorrect decision in a design downselect or to a subsystem that does not deliver its requisite functionality. The risk can be mitigated by completing the review.

POP MILESTONE # 4.6.22

ngVLA
Antenna Optical Design

Cost
Schedule
Scope

COST:

Labor Actuals	Expected
$	$
Material Actuals	**Expected**
$	$
Travel Actuals	**Expected**
$	$

SCOPE:

The optical design of the ngVLA antenna will be updated, with an emphasis on the down-select of major optical parameters. Shaping profiles will be investigated to optimize G/T_{SYS} with Gaussian feed horns.

SCHEDULE:

Milestone	Schedule	Target
1. Revised optical design	3/30/2019	6/30/2020

RISK & MITIGATION:

Risk	Mitigation
1. Less than optimal aperture efficiency and/or a late optical design introduces major structural changes to the antenna.	1. Ensure the optical design is optimized prior to the completion of a detailed mechanical design of the antenna.

15 QSU4 FY2019

COST: No impact.

SCOPE: No impact.

SCHEDULE: The current optical design for the ngVLA antenna continues to look very good, and we aren't expecting major changes to it. The risk of using the existing model, and then having to make major changes to the structural design, has decreased. However, additional trade studies and engineering analyses need to be completed before the new optical design is done. The urgency of completing this milestone has greatly diminished. Considering other priorities and project needs, the new optical design does not need to be completed until Q3 FY2020. The delay should not affect the overall mechanical design as that process appears more lengthy than originally anticipated.

RISK & MITIGATION: The ultimate intent of the optical design is to optimize the aperture efficiency of the antennas. The higher the efficiency, the fewer number of antennas need to be built (at some level). Additionally, there was some concern that the optimized optical design would have major impacts on the structural design of the antenna, but this seems not to be a major design driver. The optical design needs to be finalized prior to the completion of the antenna's mechanical design.

POP MILESTONE # 4.6.29

Cost
Schedule
Scope

ngVLA
Wide Band Feed Designs

COST:

Labor Actuals	Expected
$	$
Material Actuals	**Expected**
$	$
Travel Actuals	**Expected**
$	$

SCOPE:

Develop new designs for the two lowest frequency bands on the ngVLA, with emphasis on even illumination with frequency and reduction of the high spillover that exists in the current design. The deliverable is a preliminary design suitable for prototype fabrication.

SCHEDULE:

Milestone	Schedule	Target
1. Complete design of wide band feeds	9/30/2019	11/30/2019

RISK & MITIGATION:

Risk	Mitigation
1. There is no risk with the minor delay in the delivery of the designs.	1. N/A
2. Performance requirements for the feed cannot be met (unlikely).	2. Accept performance of existing designs or pursue additional designs that meet performance requirements at the expense of schedule delay in the baseline design.

16 QSU4 FY2019

COST: No impact.

SCOPE: No impact.

SCHEDULE: Contracts were let to CSIRO in Australia and EMSS in South Africa to design these feeds. The designs are nearly complete. The final reports on the designs are expected to be delivered by November 2019.

RISK & MITIGATION: Current designs for the two receivers will work, but not with the performance desired by the project. CSIRO and EMSS have demonstrated their ability to design feeds to the desired performance levels on other telescopes. Their task is to adapt those previous designs to the ngVLA. Thus, the risk of the new designs not achieving the desired performance is low. There is no risk associated with the minor delay in the delivery of the designs. In the unlikely event that the performance requirements cannot be met, the project will need to decide whether to accept the performance of existing feed designs or to pursue additional designs that meet the requirements at the expense of schedule delay in the baseline design.

POP MILESTONE # 4.6.31

Cost
Schedule
Scope

ngVLA

Integrated Receiver Development Test

COST:

Labor Actuals	Expected
$	$
Material Actuals	**Expected**
$	$
Travel Actuals	**Expected**
$	$

SCOPE:

The Integrated Receiver concept combines downconversion, sampling, and data transmission in a light weight, compact package that offers advantages in cost, performance, and reliability. The performance of the Integrated Receiver chip will be characterized with a demonstration board.

SCHEDULE:

Milestone	Schedule	Target
1. Complete tests of the Integrated Receiver chip on a demonstration board.	9/30/2019	12/31/2019

RISK & MITIGATION:

Risk	Mitigation
1. ASIC does not perform as designed	1. Revise the design to correct shortcomings revealed in the characterization tests. 2. Adopt the discrete component design, which will require more space and cooling,.

17 QSU4 FY2019

COST: No impact.

SCOPE: No change. The Integrated Receiver concept has been demonstrated with discrete components, but this has yet to be demonstrated with the ASIC chip that includes all of the stated functionality. The purpose of this milestone is one of risk reduction in showing that the ASIC performs in accordance with its design. See ngVLA milestone 5.3.12.

SCHEDULE: The ASIC chips have been delivered, but have yet to be characterized in the demonstration board. This board is being fabricated, and the tests are expected to be complete by December 2019.

RISK & MITIGATION: If the ASIC does not perform as intended, its design could be revised to address the shortcomings identified in the characterization tests. However, this could be at considerable cost since it might require another (expensive) wafer run for the ASIC. Alternatively, the ASIC development effort could be abandoned in favor of the discrete component design, which has been demonstrated to work. However, the discrete component design will require more space and cooling, and is likely to be less reliable than the ASIC design.

POP MILESTONE # 5.3.4

CDL

CUP ASIC Devices (prototype)

COST:

Material Actuals	Expected
$471k + $260 k ("hold fee") spent ($4075k contracted)	$3600 budgeted

(1) Amounts include total scope of work, including production units.
(2) $260k additional "Team On-Hold" fee added to vendor contract, another $471k payment was due on 7/23.

SCOPE:

The ASIC design was yet to be reworked in light of issues discovered by the S3 ASIC semiconductor team on the original design submitted to them.

SCHEDULE:

Milestone	Schedule	Target
1. Receive engineering ASIC prototype from vendor	9/30/2019	Canceled

Note: An extensive re-baselining/evaluation of the project concluded with project cancellation.

RISK & MITIGATION:

Risk	Mitigation
1. Several design errors were detected in the first iteration design, which employed non-standard hierarchical methodology in its implementation, excluded testability considerations and lacked timing simulations.	1. Redesign effort would have resulted in new testable VHDL code addressing all of the shortcomings, thereby substantially improving the chances of success when the ASIC was implemented.

18 QSU4 FY2019

COST:

- The S3 ASIC vendor assessed a one time, "team on-hold" fee of $260k to agree to NRAO's request for schedule change to allow time to correct the VHDL design.
- Budgeted amount was set at the PDR, but the actual ASIC RFPs were sent out afterwards. Four out of five bids came out above what was budgeted and the one under didn't meet the technical requirements and got a low score.
- Difference between the contracted and budgeted values was planned to be paid by using contingency funds (sufficient contingency funds were budgeted and were available).
- Another $471k payment were due on July 23rd for the mid-point review.

SCOPE:

- Numerous architectural and implementation issues were uncovered on the application specific IC (ASIC) at the heart of the correlator engine. These issues carried a high risk of failure, and they were found to be systemic, not just isolated issues.
- ASIC design was yet to be reworked.

SCHEDULE: An extensive re-baselining/evaluation of the project concluded with project cancellation.

RISK & MITIGATION: The ASIC development was at very high risk due to:

- Several design errors in the first iteration design.
- Non-standard hierarchical design methodology that was adopted.
- Use of non-standard implementation practices.
- Exclusion of considerations for testability.
- No timing data simulations were performed on the first iteration VHDL design.
- Amount of rework to correct all of the above deficiencies add a lot of risk.

The redesign effort would have resulted in new VHDL code and address all of the above, thereby substantially improving the chances of success when the ASIC is implemented. But a re-baselining/evaluation of the project concluded with project cancelation.

POP MILESTONE # 5.3.5

CDL

CUP circuit card assemblies

COST:

Labor Actuals	Expected
$	$
Material Actuals	**Expected**
$	$
Travel Actuals	**Expected**
$	$

SCOPE:

The FPGA designs on most of the circuit card assemblies had designed-in obsolescences, did not address critical timing issues, and utilized an obsolete design methodology – consequently the circuit card assemblies with these devices had to be redesigned. The microcontroller circuitry on the majority of circuit card assemblies was obsolete and these devices also needed to be redesigned.

SCHEDULE:

Milestone	Schedule	Target
1. CUP circuit card assemblies	6/30/2019	5/6/2020

Note: An extensive re-baselining/evaluation of the project concluded with project cancellation.

RISK & MITIGATION:

Risk	Mitigation
1. Delay in completion of the ASIC design (due to required rework) would have caused a knock-on delay in the start of circuit card assemblies. Also, a delay in the delivery of the ASIC would have delayed the testing of the circuit cards.	1. Additional schedule was requested to address this foreseen issue, but the project has been canceled.

19 QSU4 FY2019

COST: Extensive rebaselining would have determine revised/new cost moving forward. An extensive re-baselining/evaluation of the project concluded with project cancellation.

SCOPE: The FPGA designs on most of the circuit card assemblies had designed-in obsolescences, did not address critical timing issues, and utilized an obsolete design methodology – consequently the circuit card assemblies with these devices had to be redesigned. The microcontroller circuitry on the majority of circuit card assemblies was obsolete and these devices also needed to be redesigned. Extensive rebaselining would have determines the revised scope moving forward, but resulted in project cancellation.

SCHEDULE: Additional schedule was requested to accommodate delay in designing these cards due to added work scope for the ASIC redesign (milestone #5.3.4) and also to accommodate the delay in delivery of the ASIC. Extensive rebaselining would have determined the revised schedule, but resulted in project cancelation.

RISK & MITIGATION: Delay in completion of the ASIC design (due to required rework) would have caused a knock-on delay in the start of circuit card assemblies. Also, a delay in the delivery of the ASIC would have delayed the testing of the circuit cards. Additional schedule was requested to address this foreseen issue, but the project has been canceled.

POP MILESTONE # 5.3.6

CDL

Design Band 6v2 Nb/AlN/Nb SIS mixer

COST:

Labor Actuals	Expected
$	$
Material Actuals	**Expected**
$	$
Travel Actuals	**Expected**
$	$

SCOPE:

Cancelled. Deliver SIS mixer design to UVML for mask-set layout and fabrication.

Finished designing the Si-membrane substrate with the waveguide probe and transition to Capacitively loaded Coplanar Waveguide Currently optimizing the tuning circuit around the junctions. When that is done, will continue the dialog with UVML to finalize the fabrication process steps and secondary mask levels (vias, beam leads, etc.)

SCHEDULE:

Milestone	Schedule	Target
1. Design Band 6v2 Nb/AlN/Nb SIS mixer	9/30/2019	Cancel this milestone. Work will be tracked under a new FY2020 milestone that is already in POP2020.

RISK & MITIGATION:

Risk	Mitigation
1. Not applicable. In progress work subsumed into an approved ALMA development study proposal.	1. Not applicable.

20 QSU4 FY2019

COST: No impact.

SCOPE: No impact.

SCHEDULE: Previously this was a CDL development task intended to ultimately inform an ALMA development project. The completion of this goal has been subsumed into an approved ALMA development study proposal, and will be tracked as a FY2020 milestone.

RISK & MITIGATION: No impact.

POP MILESTONE # 5.3.7

CDL

Evaluate upgraded balanced IF amplifiers

COST:

The added scope requires an additional budget of $75k. A CRE was submitted and approved for additional funds.

SCOPE:

Originally, this work was a follow on iteration after a POP2018 milestone for 4-12 GHz Balanced IF amplifier. After the Band 6v2 CoDR, the scope has been revised to implement a wider bandwidth (4-16 GHz) balanced IF amplifier, which required new component CLNAs as well as design and manufacture of new superconducting IF hybrids. Also included in the scope is evaluation of edge-mode isolators as an alternate to balanced amplifiers.

SCHEDULE:

Milestone	Schedule	Target
1. Evaluate upgraded balanced IF amplifiers	6/30/2019	Cancel this milestone. Subsumed into a FY2020 milestone.

The added scope required an additional schedule of about and year. A CRE was submitted and approved for the approval of this additional schedule of one year.

RISK & MITIGATION:

Risk	Mitigation
1. Additional scope caused the original milestone date to be missed as well as the budget to be exceeded.	1. Impact assessment carried out and a formal change request was submitted and approved to extend the schedule and budget for this task.

21 QSU4 FY2019

COST: Cost impact assessment indicated that the added scope requires an additional budget of $75k. A CRE was submitted and approved for additional funds.

SCOPE: Originally, this work was a follow on iteration after a POP2018 milestone for 4-12 GHz Balanced IF amplifier. After the Band 6v2 CoDR, the scope has been revised to implement a wider bandwidth (4-16 GHz) balanced IF amplifier, which required new component CLNAs as well as design and manufacture of new superconducting IF hybrids. Also included in the scope is evaluation of edge-mode isolators as an alternate to balanced amplifiers.

SCHEDULE: Schedule impact assessment indicated that the added scope requires an additional schedule of 12 months. A CRE was submitted and approved for this additional schedule of one year. Included in FY2020 POP.

RISK & MITIGATION: Additional scope caused the original milestone date to be missed as well as the budget to be exceeded. Impact assessment was carried out and a schedule change CRE was filed and approved.

POP MILESTONE # 5.3.12

Cost
Schedule
Scope

CDL

Test SADC prototype ASIC

COST:

Labor Actuals	Expected
$	$
Material Actuals	**Expected**
$	$
Travel Actuals	**Expected**
$	$

SCOPE:

While we have the prototype ASIC on hand, testing it has been delayed due to lack of critical staff who had been assigned to other time-critical tasks. (the now canceled ALMA CUP ASIC effort).

Additional schedule requested to allow completing the ongoing circuit board layout and fabrication tasks prior to testing.

SCHEDULE:

Milestone	Schedule	Target
1. Test SADC prototype ASIC	6/30/2019 Revised to 9/30/2019	12/31/2019 requested

RISK & MITIGATION:

Risk	Mitigation
1. There was a lack of available time on the part of relevant DSP staff to devote to this project.	1. Had hired additional DSP staff at the CDL, to relieve critical staff needed to complete this project. In the meanwhile CUP effort has been canceled, so staff can devote time to this effort.

22 QSU4 FY2019

COST: No impact.

SCOPE: No impact.

SCHEDULE: As explained above, it is foreseen that additional schedule is required to complete this task.

RISK & MITIGATION: There was lack of available time on the part of relevant DSP staff to devote to this project. CDL had hired additional DSP staff to relieve critical staff needed to complete this project. In the meanwhile CUP effort has been canceled, so staff can devote time to this effort.

POP MILESTONE # 6.7.17

SSR (SRDP)

Pilot Operations Complete

Cost
Schedule
Scope

COST:

Labor Actuals	Expected
$	$ no change
Material Actuals	Expected
$	$ no change
Travel Actuals	Expected
$	$ no change

SCOPE:

No change to overall project scope.

Priorities were adjusted to exchange some of the delivered capability between the Pilot and Wave 1, primarily to support large projects earlier than planned.

SCHEDULE:

Milestone	Schedule	Target
1. End of Pilot Ops	Sep 30, 2019	Dec 1, 2019

RISK & MITIGATION:

Risk	Mitigation
1. Defer Workspace System	1. Support operations with workflow scripts

23 QSU4 FY2019

COST: No impact.

SCOPE: No Change to overall project scope, priorities were adjusted to exchange some scope items between Pilot and Wave 1.

SCHEDULE: The initial plan allowed for a cessation of SRDP Pilot Operations; anticipating a potential need for process or code modifications prior to declaring readiness for full operational support in Wave 1. This buffer period was to provide approximately 90 days following the Pilot before beginning Wave 1 Operations. A decision was taken to extend the Pilot Operations through most of this 90 day period for two reasons: First, there were approved changes in the priority of delivered scope resulting in a delay to provide the ALMA User Driven Imaging (AUDI). The project responded to this delay by establishing a mid-pilot release for the AUDI capability, where additional time allowed for the capability to be exercised more fully in the operational environment. The capability delivered at the launch of Pilot Operations has proven to be stable, so this buffer was not needed for code maintenance on delivered capability. Second, the scope change also resulted in descoping the Workspace System from the Pilot, moving it into Wave 1. The Workspace System is to automate a number of workflows which have been temporarily addressed with less automated processes during the Pilot, therefore the buffer was not needed for making process modifications either. The overall result is good news for archive users. The Pilot launched relatively on time (~two week delay from initial baseline). The capability delivered during Pilot will continue uninterrupted through the launch of Wave 1 Operations.

RISK & MITIGATION: The decision to defer the Workspace System in favor of incorporating the Product System provides earlier support for large projects, but moves the validation and operational deployment of critical automated processes into Wave 1, where we expect the user base (and visibility) to increase. This risk was acknowledged and accepted at the time of the decision. Mitigation for this risk is to support the workflow scripts which were deployed in lieu of the Workspace System. Functionality provided by the scripts vs. the Workspace System is transparent to the user.

POP MILESTONE # 6.7.25

SSR

Scientific User Support: Guides for CASA 5.6

COST:

Labor Actuals	Expected
$	$
Material Actuals	**Expected**
$	$
Travel Actuals	**Expected**
$	$

SCOPE:

Milestone Cancelled. Due to the delay in the release of CASA V5.6 and the staff resources needed to run the 7th Annual Data Reduction workshop, NRAO decided to cancel the update of the V5.6 Guide. Instead we only updated the VLA Pipeline CASA Guide when V5.6 was released.

SCHEDULE:

Milestone	Schedule	Target
1. Guides updated to reflect CASA V5.6	9/30/2019	11/30/2019

RISK & MITIGATION:

Risk	Mitigation
1. Low	1. Existing guides are sufficient.

24 QSU4 FY2019

COST: No impact.

SCOPE: No impact.

SCHEDULE: This milestone is cancelled. We will update the Guides in FY2020 when CASA V5.7 and V6.2 are released. These milestones are in the FY2020 POP.

RISK & MITIGATION: Risk is low. Apart from the VLA pipeline, we will keep the guides as they are now in V5.5.

POP MILESTONE # 6.7.27

SSR

NRAO Papers replacement

COST:

Labor Actuals	Expected
$	$
Material Actuals	**Expected**
$	$
Travel Actuals	**Expected**
$	$

SCOPE:

Milestone Cancelled. No new software required at this time. In milestone #6.7.26, we concluded that functional improvements in existing software did not require new software to be developed at this time.

SCHEDULE:

Milestone	Schedule	Target
1. Software requirements from the committee were to be accepted and evaluated.	9/30/2019	

RISK & MITIGATION:

Risk	Mitigation
1. Low	1. No mitigation

25 QSU4 FY2019

COST: No impact.

SCOPE: No impact.

SCHEDULE: This milestone is cancelled.

RISK & MITIGATION: Risk is low. No mitigation required at this time.

POP MILESTONE # 7.5.21

DMS

CASA 6.0 Release

Cost
Schedule
Scope

COST:

Labor Actuals	Expected
DMS funds this activity at a higher WBS level.	
Material Actuals	Expected
$	$
Travel Actuals	Expected
$	$

SCOPE:

Major upgrade to the CASA environment, providing a modularized industry standard representation of CASA that is Python 3.6 compliant. Baselined to ALMA Cycle 7 release for migration of pipeline and user base over the subsequent year.

SCHEDULE:

Milestone	Schedule	Target
1. CASA 6 beta preview		complete
2. CASA 6 release	6/28/2019	11/22/2019

RISK & MITIGATION:

Risk	Mitigation
1. Orphaned legacy functions and GUIs	1. Additional staff assignments
2. User response to new modularization	2. Replicate old interface as optional mode

26 QSU4 FY2019

COST: DMS funds this activity at a higher WBS level. Costs are not tracked for this milestone.

SCOPE: Major upgrade to the CASA environment, providing a modularized industry standard representation of CASA that is Python 3.6 compliant. Baselined to ALMA Cycle 7 release for migration of pipeline and user base over the subsequent year.

SCHEDULE: CASA 6.x is being developed to provide a parallel testing path for the 5.x series of production releases. The original schedule was changed to align with ALMA Cycle 7 so that ALMA can migrate to CASA 6 for Cycle 8 using with the ALMA Cycle 7 as a comparison baseline. A beta preview release was made available on the original timeline to allow users to get experience with the new software and make modifications to their own software that depends on CASA. Technical challenges in creating a monolithic release for the pipeline have delayed the official release. Completion is anticipated in Q1 FY2020.

RISK & MITIGATION: 1) CASA has functions and GUI's which the current development team does not have experience with. Staff will be reassigned from other CASA tasks to provide migration support. 2) Many current are used to a monolithic package containing a custom environment preconfigured for them. For users that prefer this, the old interface will be replicated as an optional mode. Note that our new industry standard approach will be more familiar to the Python community and provide more flexibility.

POP MILESTONE # 7.5.26

DMS

New Archive Default

Cost
Schedule
Scope

COST:

Labor Actuals	Expected
DMS funds this activity at a higher WBS level.	
Material Actuals	Expected
$	$
Travel Actuals	Expected
$	$

SCOPE:

The New Archive will become the default in Q4.

SCHEDULE:

Milestone	Schedule	Target
1. New Archive Default	Sept 30, 2019	June 30, 2020

RISK & MITIGATION:

Risk	Mitigation
1. Support of old archive	1. Part-time contract with retired archive support person

27 QSU4 FY2019

COST: DMS funds this activity at a higher WBS level. Costs are not tracked for this milestone.

SCOPE: The New Archive will become the default in Q4.

SCHEDULE: A punch list of tasks to enable the New Archive to replace the current one was developed. Work was delayed due to the higher priority of the initial SRDP delivery and ongoing VLASS support. The team is has also been (and continues to be) understaffed by two to three positions. Completion is carried over as a FY2020 milestone.

RISK & MITIGATION: The primary risk is in the technical debt in the old (production) archive, leading to difficulty of supporting it. A retired former employee has been retained on a part time contract to provide his expertise and effort to supporting it while it continues.

POP MILESTONE # 7.5.36

Cost
Schedule
Scope

DMS

Full-Mueller Imaging

COST:

Labor Actuals	Expected
DMS funds this activity at a higher WBS level.	
Material Actuals	Expected
$	$
Travel Actuals	Expected
$	$

SCOPE:

Commission the Full-Mueller imaging algorithm to enable wide-field, wide-band full-Stokes imaging with VLA and ALMA.

SCHEDULE:

Milestone	Schedule	Target
1. Memo on full polarization primary beam modeling		March 2020
2. Memo/ implementation of Full-Mueller imaging	June 30, 2019	September 2020

RISK & MITIGATION:

Risk	Mitigation

28 QSU4 FY2019

COST: DMS funds this activity at a higher WBS level. Costs are not tracked for this milestone.

SCOPE: Commission the Full-Mueller imaging algorithm to enable wide-field, wide-band full-Stokes imaging with VLA and ALMA. This work requires code implementation, scientific verification with simulated and real data, and documentation (software design, scientific test results).

SCHEDULE: The priority for this task was lowered in favor of AW-Projection algorithm commissioning work required due to a change in VLASS priories. The infrastructure code for this task has been implemented. Work for scientific verification with simulated and real data, and the associated memo is still in progress. Completion is carried over as a FY2020 milestone.

RISK & MITIGATION: No impact.

POP MILESTONE # 8.5.6

Cost
Schedule
Scope

PMD

Program Management Software Solution Implementation

COST:

Labor Actuals	Expected
$	$
Material Actuals	**Expected**
$25,000	$25,000
Travel Actuals	**Expected**
$	$

SCOPE:

The extent to which a comprehensive project management software solution is implemented across the observatory depends on the growth of PMD and the ngVLA project office.

SCHEDULE:

Milestone	Schedule	Target
1. Implementation	June 2019	June 2020

RISK & MITIGATION:

Risk	Mitigation
1. Staffing for implementation.	1. Fill PMD vacancies prior to full implementation.
2. Buy-in from other depts.	2. Ongoing stakeholder mgmt.

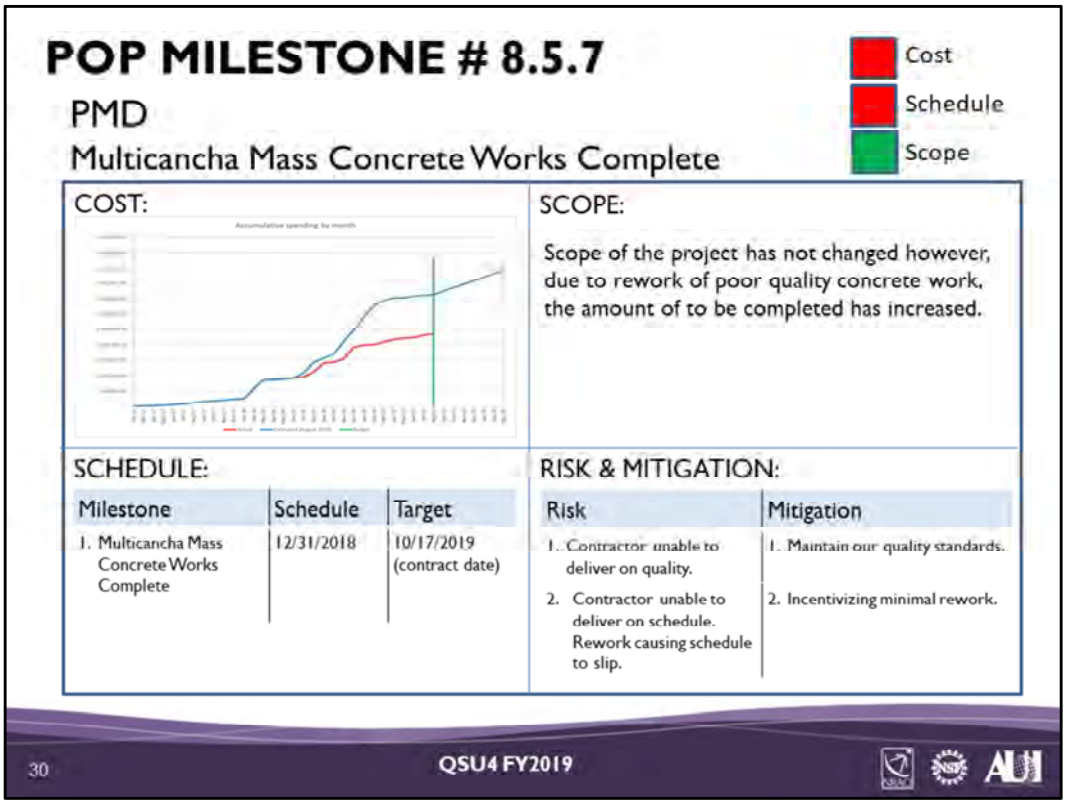
29 QSU4 FY2019

COST: Costs incurred thus far include 10 licenses of Oracle Primavera Cloud (1 year) and training from Oracle consulting team.

SCOPE: No changes in scope have been made; however, the exact extent to which the software solution will be implemented has not yet been decided. Ten licenses have been renewed for one additional year.

SCHEDULE: No final decision was made on whether to proceed with Oracle Primavera Cloud. PMD has completed training conducted a requirements analysis comparing different tools. In conjunction with the expected build-up of the ngVLA project team, PMD will make a decision on the path forward.

RISK & MITIGATION:
1) The effort for implementation requires migrating all current projects to a new database, changing numerous department processes, and working with other departments (Budget, Director's Office) to change the way we process project data and conduct reporting. In order to ensure success, this will need to wait until PMD returns to full staffing levels.
2) This will represent a major change in how projects are managed with broad impacts to other departments. Other departments need to be engaged early and often so that all requirements are fully known and there are no surprises during the process.

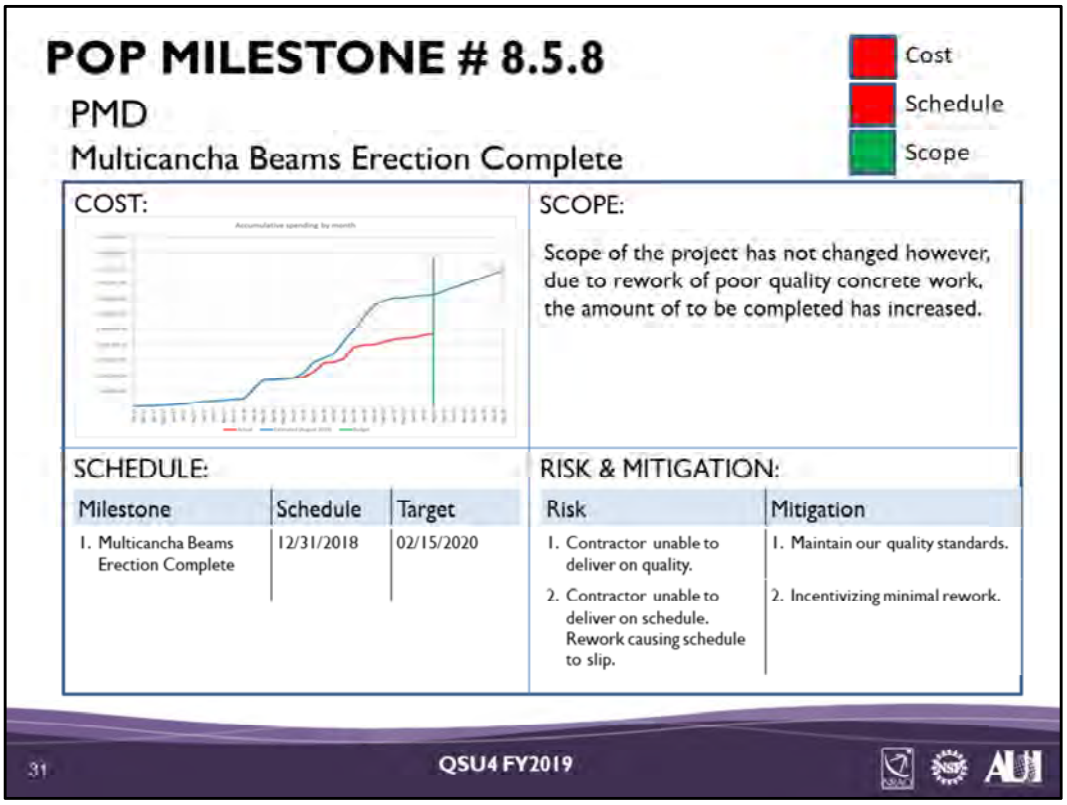


COST: This is a fixed price contract represented by the green bar in the chart. **On September, 2019, NRAO and contractor signed an addenda which includes a series of bonuses to Toptent and a new more realistic project term date. Construction completion on February 15th, 2020; and contract end on April 15th, 2020**. The management overcost will be ~USD220k, which should be covered by the project contingency.

SCOPE: No change in scope.

SCHEDULE: Contractor sent an updated construction schedule with a construction term date on **February 15th, 2020.**

RISK & MITIGATION: Quality remains an issue. We have closely monitored the quality of work and submitted non conformance reports on each issue. We also have recommended a change of site management to the contractor as part of the contract renegotiation with incentives**.** Contractor accepted this request and changed most of this technical office on site. In addition, Contractor added more technical staff to improve performance. The contractor changed some key positions on site including the construction manager, field chiefs, quality supervisor (two on site) and project controller. **The bonuses agreed in the addenda, are designed to mitigate the risk that the contractor leaves the project due to financial issues.**



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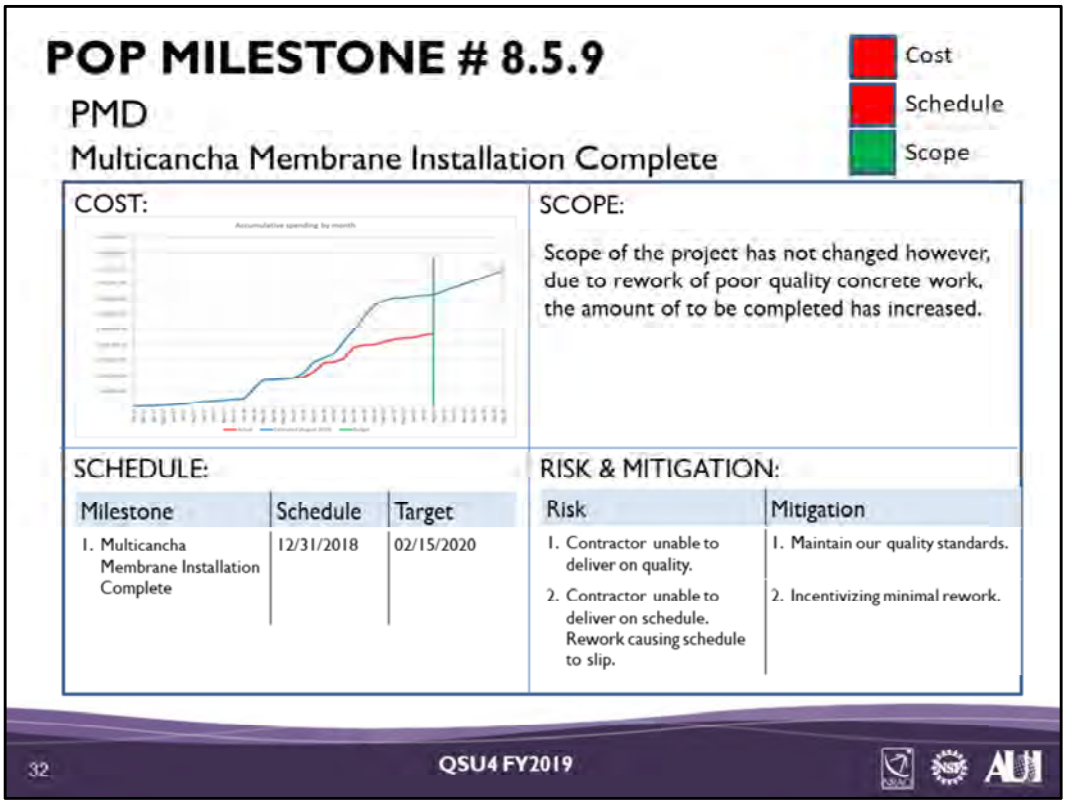

COST: This is a fixed price contract represented by the green bar in the chart. **On September, 2019, NRAO and contractor signed an addenda which includes a series of bonuses to Toptent and a new more realistic project term date. Construction completion on February 15th, 2020; and contract end on April 15th, 2020**. The management overcost will be ~USD220k, which should be covered by the project contingency.

SCOPE: No change in scope.

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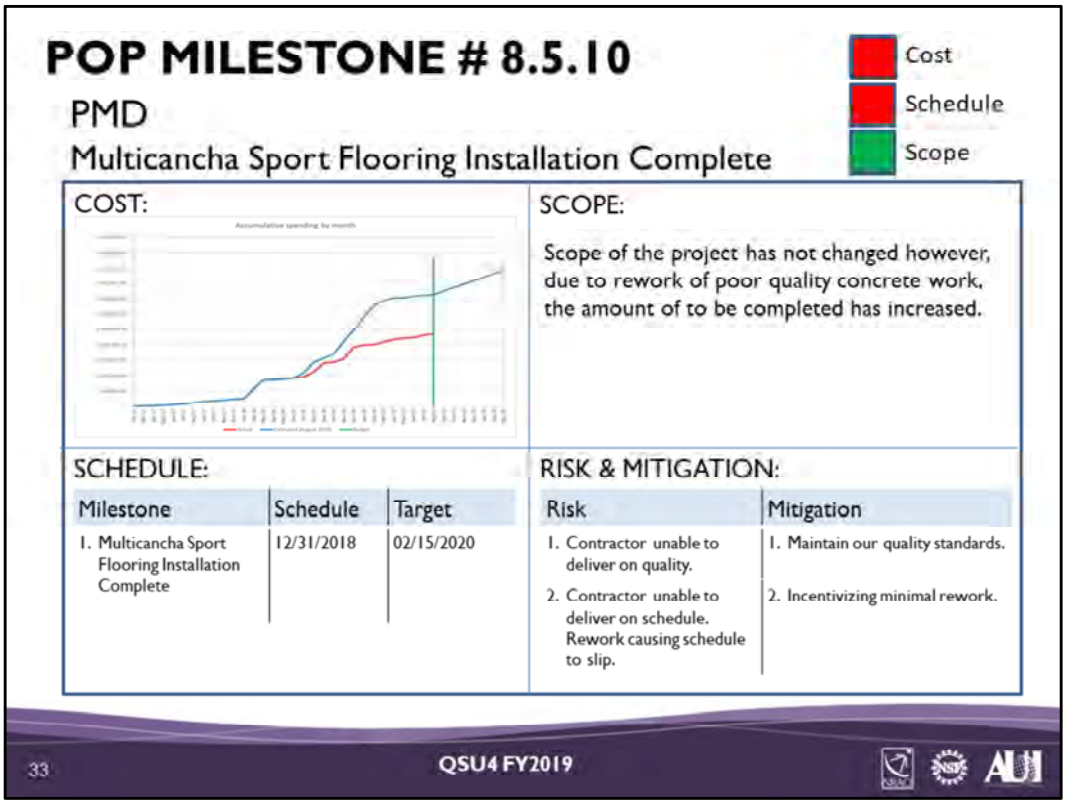

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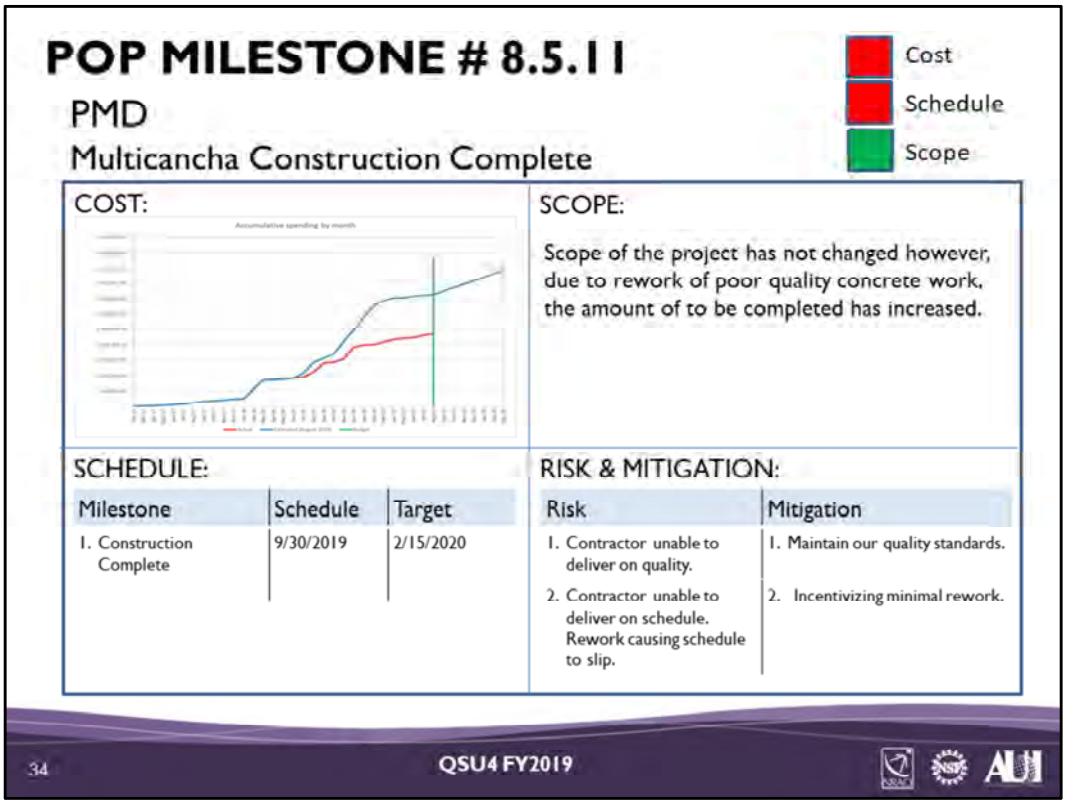

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POP MILESTONE # 8.5.13

PMD (SRDP)

Wave 1 Review

Cost
Schedule
Scope

COST:

Labor Actuals	Expected
$	$ No change
Material Actuals	Expected
$	$ No change
Travel Actuals	Expected
$	$ No change

SCOPE:

No change to overall project scope.

This milestone has a dependency on 6.7.17, priorities on delivered scope changed which had an impact on this milestone.

SCHEDULE:

Milestone	Schedule	Target
1. Wave 1 Review	Aug 15, 2019	Q1 FY2020

RISK & MITIGATION:

Risk	Mitigation
1. Delayed feedback from Review	1. Lessons learned are informally incorporated into weekly meetings until a review is held

35 QSU4 FY2019

COST: No impact.

SCOPE: No change to overall project scope, priorities were adjusted to exchange some scope items between Pilot and Wave 1. This review is to provide a post mortem assessment on experience gained in the Pilot Operations and capture lessons for use in the Wave 1 planning. A Mid-Pilot review was initially scheduled in order to exploit this experience prior to the end of Pilot.

SCHEDULE: Changes to priority in the delivered scope resulted in a delay to schedule this review, since the review intended to include the delayed capability.

RISK & MITIGATION: This review serves as a protection mechanism to formally capture lessons learned and apply process improvements in a timely fashion. Delaying the review introduces a risk that poor practices become more deeply entrenched and are more difficult to change. This was recognized, with the result that lessons learned were captured and discussed as they were encountered, allowing some improvements to go forward prior to holding a review.

POP MILESTONE # 8.5.17

PMD

New Mexico Continuing Education

COST:

Labor Actuals	Expected
$	$
Material Actuals	**Expected**
$	$
Travel Actuals	**Expected**
$	$

SCOPE:

Provide Project Management and Systems Engineering education to the staff in New Mexico. Cancelled.

SCHEDULE:

Milestone	Schedule	Target
1. Provide Continuing Education	9/30/2019	Cancel

RISK & MITIGATION:

Risk	Mitigation
1. Continue to miss training opportunities in NM	1. Hire a PM/SE asap. Included in POP 2020 Milestones.

COST: No impact.

SCOPE: No impact.

SCHEDULE: The PM/SE position in NM has been vacant for five months. Cancel training until new hire is in place.

RISK & MITIGATION: No impact.

POP MILESTONE # 8.5.20

Cost
Schedule
Scope

PMD

VLBA Fiber Final Service Analysis Report

COST:

Labor Actuals	Expected
$ 24,655.00	$ 148,273.00
Material Actuals	**Expected**
$ 1,140,149.00	$ 2,336,895.00
Travel Actuals	**Expected**
$ 906.00	$ 14,832.00

SCOPE:

Provide VLBA Fiber Final Service Analysis Report

SCHEDULE:

Milestone	Schedule	Target
1. VLBA Fiber Final Service Analysis Report	9/30/2019	03/31/2020

RISK & MITIGATION:

Risk	Mitigation
1. Project will not complete within the period of performance	1. Request a no cost extension from NSF

37 QSU4 FY2019

COST: No impact.

SCOPE: No impact.

SCHEDULE: Los Alamos and Hancock Fiber will not be installed until December 2019. Delays at Los Alamos caused by working through DOE and LANL contracting to get project approval, permits and a contract in place. Payment was made in October 2020 to initiate fiber install to the Antenna. Delays at Hancock caused by working through University of New Hampshire Contracting Office to get them to contract outside vendor to install the 15 miles of fiber. Quality assurance of the these connections will be performed once the service is turned on.

RISK & MITIGATION: We will request a no-cost extension from NSF.

POP MILESTONE # 8.5.28

Cost
Schedule
Scope

PMD

CDL Continuing Education

COST:

Labor Actuals	Expected
$	$
Material Actuals	**Expected**
$	$
Travel Actuals	**Expected**
$	$

SCOPE:

Risk management training to CDL staff

SCHEDULE:

Milestone	Schedule	Target
1. Training session	9/30/2019	10/25/2019 (complete)

RISK & MITIGATION:

Risk	Mitigation
1. No impact	

38 QSU4 FY2019

COST: No impact.

SCOPE: No impact.

SCHEDULE: Training session was completed on 10/25/2019.

RISK & MITIGATION: No impact.

POP MILESTONE # 8.5.32

PMD

ALMA Correlator Upgrade Critical Design Review

COST:

Labor Actuals	Expected
$	$
Material Actuals	**Expected**
$	$
Travel Actuals	**Expected**
$	$

SCOPE:

The Correlator Upgrade Project was cancelled and there will be no more reviews. This milestone should be cancelled.

SCHEDULE:

Milestone	Schedule	Target
1. CDR	Cancelled	N/A

RISK & MITIGATION:

Risk	Mitigation
1. No impact	None

39 QSU4 FY2019

COST: No effort has been expended on preparing for the CDR.

SCOPE: The Correlator Upgrade Project was cancelled and there will be no more reviews.

SCHEDULE: No impact.

RISK & MITIGATION: No impact.

FY2019 Milestone Carryover Chart

FDP Milestone	Milestone	Completion Date		Q4 Performance Assessment: Cost	Schedule	Status
2.1	[illegible]					
	[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]			
	[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]			
3.1	[illegible]					
	[illegible]					
	[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]			
	[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]			
	[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]			
4.0	[illegible]					
	[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]			
5.2	[illegible]					
	[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]			
6.1	[illegible]					
	[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]			
6.3	[illegible]					
	[illegible]					
[illegible]	[illegible]	[illegible]	[illegible]			
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[illegible]	[illegible]	[illegible]	[illegible]			

FY2018 Milestone Carryover Chart

						Q4 FY2019		
POP Section	POP Milestone	Milestone	POP Completion Date	New Completion Date		Cost	Sched	Scope
4.3		**Central Development Laboratory**						
		Research and Development						
	8	Explore DOMT calibration using hot-cold noise	9/30/2018	Q1 FY2020	4-Square			
		ngVLA						
4		***Conceptual Design & Development***						
	12	Algorithmic Study released	9/30/2018	Q1 FY2020	4-Square			
	15	RFI Mitigation study released	9/30/2018	Q1 FY2020	4-Square			
3.11		**Long Baseline Observatory**						
		Operational Activities						
	9	VME replacement program will be complete	9/30/2018	Q1 FY2020	4-Square			

FY2018 POP # 4.3.8

Central Development Laboratory

Explore DOMT calibration using hot-/cold-noise

Cost
Schedule
Scope

COST:

Labor Actuals	Expected
$	$
Material Actuals	**Expected**
$	$
Travel Actuals	**Expected**
$	$

SCOPE:

W-Band IRD Front End (on which the DOMT calibration scheme will be evaluated) testing was previously slowed due to a number of technical issues (as explained the FY2018 QSU4 & FY2019 QSU1). Most of those have been now resolved.

The W-Band IRD receiver(s) have been commissioned. Some issues with reading data from two sources simultaneously, as reported last quarter, have been addressed and modifications to clock the two modules synchronously have been made. Algorithm has already been formulated and is being programmed. Additional schedule requested.

SCHEDULE:

Milestone	Schedule	Target
1. Experimental test data (frequency response)	9/30/2018 in POP FY2018	Was delayed to 3/29/2019, 6/29/2019 then 9/30/2019. Revised to 12/31/2019

RISK & MITIGATION:

Risk	Mitigation
1. On a near term, there is lack of available time on the part of relevant DSP staff to devote to this project, SADC work was prioritized above this work.	1. Have hired additional DSP staff at the CDL, to relieve critical staff needed to complete this project.

42 QSU4 FY2019

COST: No consequential change in cost performance.

SCOPE: No change in scope, originally proposed experimental test data (frequency response) is still proposed to be collected and delivered.

SCHEDULE: This milestone requires a second W-band front-end, which has been built, debugged and are operational. Coding is ongoing, following which testing will follow. Consequently, we expect to complete this milestone by the end of Q1 FY2020 (milestone was previously modified in Q3 FY2019).

RISK & MITIGATION: Previously, there was lack of available time on the part of relevant DSP staff to devote to this project. Have hired additional DSP staff at the CDL, to relieve critical staff needed to complete this project.

FY2018 POP # 4.12

ngVLA Algorithmic Study

Cost
Schedule
Scope

COST:

Labor Actuals	Expected
$	$
Material Actuals	**Expected**
$	$
Travel Actuals	**Expected**
$	$

SCOPE:

Conduct an analysis of the ngVLA imaging requirements, define the algorithms that will be needed in order to meet them, and estimate the required computational power that will be necessary for calibrating the observational data and synthesizing images for the science cases specified in the ngVLA reference observing program.

SCHEDULE:

Milestone	Schedule	Target
1. Algorithm study released (report/memo)	6/30/2019	12/31/2019

RISK & MITIGATION:

Risk	Mitigation
1. Under-estimation of the computational resources required by the project.	1. Maintain focus of key staff involved on this activity. 2. Characterize the estimation uncertainty in the ngVLA reference design and define adequate contingency budget for DS2020.

43 QSU4 FY2019

COST: No impact.

SCOPE: No impact.

SCHEDULE: Competing priorities within NRAO have delayed the completion of this milestone. It also required input from the ngVLA reference observing program, which has been completed. Although delayed, recent progress indicates that the study is on track to be completed by December 2019.

RISK & MITIGATION: The risk of not completing the algorithmic study is underestimating the computational resources that will be required by ngVLA to produce its expected science products. In addition, a weak estimation in this area could suggest to DS2020 that the technical concept for the array is incomplete. This risk will be mitigated by maintaining the focus of the key personnel involved on writing the report. It would also be adequate to conduct a review of this report in anticipation of requests for additional information from DS2020.

FY2018 POP # 4.15

ngVLA

RFI Mitigation Study

Cost
Schedule
Scope

COST:

Labor Actuals	Expected
$	$
Material Actuals	**Expected**
$	$
Travel Actuals	**Expected**
$	$

SCOPE:

Conduct an RFI mitigation study focused on architectural solutions and algorithmic development to mitigate the expected risks of RFI.

SCHEDULE:

Milestone	Schedule	Target
1. RFI mitigation study released (report/ memo)	9/30/2018	12/31/2019

RISK & MITIGATION:

Risk	Mitigation
1. Inadequate understanding of RFI mitigation (in data analysis) and associated computing requirements for ngVLA.	1. Maintain focus of key staff involved on this activity.

44 QSU4 FY2019

Owner: Rafael Hiriart

COST: No impact.

SCOPE: An RFI mitigation report was issued in 2018. It focuses on estimating what the RFI environment might be on the timescale of 2030. No impact at this time.

SCHEDULE: Competing initiatives within the NRAO (e.g. VLASS) have slowed progress on this milestone, and there are currently insufficient resources within NRAO to complete the RFI mitigation study on the timescale of DS2020. The new target date for this milestone is December 2019.

RISK & MITIGATION: The risk of not completing the RFI mitigation study is an inadequate understanding of the data analysis requirements needed to minimize or remove the effects of RFI from ngVLA data. This could lead to a lack of RFI mitigation techniques in data analysis for ngVLA and an underestimate of its computing requirements. It would also suggest to DS2020 that the technical concept for the array is incomplete. This risk will be mitigated by maintaining the focus of the key personnel involved on writing the report.

FY2018 POP # 3.11.9

NM Ops

VME replacement program complete

Cost
Schedule
Scope

COST:

Labor Actuals	Expected
$	$
Material Actuals	**Expected**
$	$
Travel Actuals	**Expected**
$	$

SCOPE:

Migrate all VME functionality to VLBA control computers, including retirement and replacement of legacy operator screens and utility programs.

SCHEDULE:

Milestone	Schedule	Target
1. Complete VMD replacement program	9/30/2019	12/31/2019

RISK & MITIGATION:

Risk	Mitigation
1. Increased exposure to failure of aging VME hardware	1. Use retired VME systems as spares, if needed

45 QSU4 FY2019

NOTES ARE REQUIRED FOR EACH 4-SQUARE REPORT

COST: No impact.

SCOPE: No impact.

SCHEDULE: The migration of all VME functionality to VLBA control computers was delayed by technical issues with new noVME hardware at the MK site. The technical issues at MK were resolved during the last weeks of Q4 2019, and the remaining sites, MK and PT, will be converted to noVME during the first weeks of Q1 FY2020. Operational software has reached a usable level of completion with improvements continuing to be developed. At present, eight stations have been moved to the VLBA control computers. SC was converted to noVME during Q4.

RISK & MITIGATION: The risk of further delay is increased exposure to failure of aging VME hardware between now and the end of full deployment of the new system. Now that some of the stations have been moved we have spares available, if needed.

FY2015 POP # 3.4.62

Admin (from NM Ops)

Renew VLBA lease for Owens Valley

Cost
Schedule
Scope

COST:

Current VLBA lease rate:	$500 per year
Expected new lease rate:	OVRO hopes to negotiate a lease with LADWP such that the VLBA share is < $3,000 a year.

SCOPE:

Owens Valley, CA site sub-lease with Owens Valley Radio Observatory (OVRO) is lapsed. OVRO (managed by CalTech) has received a draft lease from Los Angeles Department of Water and Power (LADWP) and they have shared it with NRAO (we have no concerns or comments). NRAO has also reviewed and approved the draft of its sub-lease with OVRO which will be signed after OVRO signs the master lease. LADWP expects the lease to officially commence Oct/Nov.

SCHEDULE:

Milestone	Schedule	Target
1. Owens Valley Lease renewed	03/31/2015	EOY 2019

RISK & MITIGATION:

Risk	Mitigation
1. Impact on VLBA operating budget (increase in lease cost – but early indications are for a modest increase)	1. Adjust VLBA Operating budget, if necessary.
2. Impact on VLBA operation	2. Avoid by periodic follow up of Caltech negotiation progress

46 QSU4 FY2019

Updated 07/8/2019

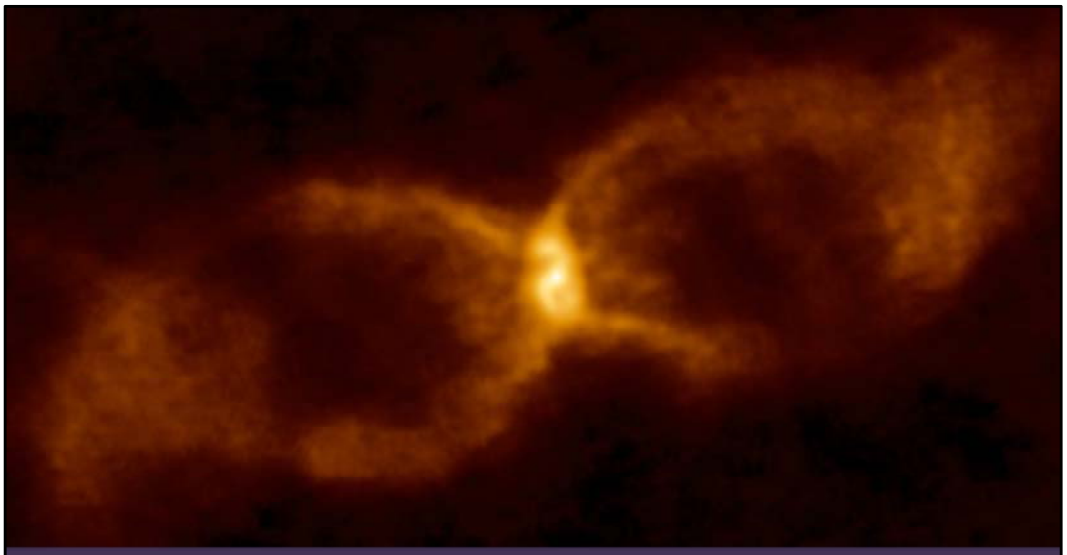
COST: Future lease costs are subject to the status of Caltech's re-negotiation of the lease with Los Angeles Water and Power.

SCOPE: No changes.

SCHEDULE: <u>Owens Valley Lease</u>: The master lease for the Owens Valley Radio Observatory is an agreement between Caltech and Los Angeles Water and Power (the lease holder). The master lease has been expired for since March 31, 2015, and renegotiating it does not appear to be a priority for LA W&P. NRAO has a sublease agreement for VLBA-OV with Caltech. We propose to cancel this milestone for FY2015 since its ultimate resolution is beyond our control. We will continue to monitor the situation with the master lease, and propose a new milestone for the sublease at the appropriate time.

RISK & MITIGATION:

1. Caltech has leased Owens Valley, CA for a low yearly fee. The probability of a cost increase is low, but a budget adjustment would be needed if a cost increase occurs.
2. Impacts on other aspects of VLBA Operations are not likely to occur.
3. An interim agreement between Caltech and NRAO regarding the sublease during this interim period has been discussed and our continued occupancy is not an issue.



QSU4 FY2019 Budget

Laura Lockledge

FY2019 General Comments

- ICC/IDC reflect FY2019 provisional rates (approved September)
- Significant ICC under-recovery impacts all carryforward FY2020 plans.
- Generally underspent
  - Shutdown
  - ngVLA
  - Slow recruitment
- Benefits @ 31.24 vs. 36% budget
  - Insurance billing (worker's comp – front loaded)
  - Vacation contribution (NSF has asked AUI not to make this)
  - Medical vendor change (Probably haven't hit steady state yet)
  - Net credited across all fund sources – $2.2M including AUI

Disclosure: Change in Accounting Practice

- During the FY2019 close process, the NRAO management organization, AUI, changed the methodology for the allocation of fringe benefits.
- Past practice was to charge benefits allocation rate (36% in FY2019) to all BU's. Any difference accumulated at the fund source level. In NSF reporting, this delta was included in the Director's Office WBS.
- Practice for year end reports was to charge actual benefits expense (31.24%) to each BU reporting wages. Benefits savings are thus reflected in each WBS.
- QSU4 financial reports are not comparable to reports from QSUs 1, 2, and 3 except at the top level (e.g. total expenses) and do not reflect management performance against budget.

CSA-V FY2019 Final (10/25/19)

- Expenses do not include $1.7M in open commitments.
- Expenses include full spend-down of planned infrastructure funding.
- Significant savings due to breakage/cross charging to ngVLA.
- Science Ops reflects DMS surge funding.

	FY19 POP Budget	FY19 Rev. Budget	FY19 YTD Expenses	YTD % Rev Budget
NSF	38,850	38,850	38,850	100.0%
Carryforward/Other	1,165	5,230	5,230	0.0%
Total Revenues	**40,015**	**44,080**	**44,080**	100.0%
Telescope Ops	11,003	12,195	10,115	82.9%
Development	3,575	2,969	2,467	83.1%
Science Ops	6,829	8,438	6,991	82.9%
Admin Services	10,249	10,449	8,202	78.5%
Director's Office	2,659	2,289	2,151	94.0%
Ed. & Public Outreach	782	793	706	89.0%
ngVLA	4,918	6,947	5,329	76.7%
FY19, Total	**40,015**	**44,080**	**35,961**	**81.6%**
FY19 CSA-V Net	**0**	**0**	**8,119**	

CSA-V FY2019 Balance Management

FY19 Sources		FY20 Allocations	
Uncommitted Carryover	6,446	Uncommitted Carryover	6,446
ngVLA contract reserve	(1,100)	ngVLA contract reserve	(1,100)
DMS 2 year surge balance	(1,048)	DMS 2 year surge balance	(1,048)
Fringe surplus	-	ngVLA FY20 commit	(2,500)
Critical Infrastructure Reserve	(1,791)	ICC reserve	(265)
NM Ops underspend	(985)	CIS/Backup File System	(200)
ICC underspend	(424)	VLBA Decommissioning Study	(187)
All Other Underspends	(1,099)	FY20 Infrastructure Reserve	(1,147)

* Underspends include FB allocation.

CSA-A FY2019 Final (10/25/19)

- Dev: CUP project cancelled. No new project awards. Cycle 7 studies awarded in FY19 to start in FY20.
- Admin: Multicancha delays. Lower ICC and IDC.
- EPO salary breakage plus associated underspends.
- Currency savings enabled reserve of Canadian funds.

	FY19 POP Budget	FY19 Rev. Budget	FY19 YTD Expenses	YTD % Rev Budget
NSF	40,280	40,280	40,280	100.0%
Carryforward	9,363	10,767	10,767	100.0%
Canadian Contribution	2,809	0	0	0.0%
Other	848	760	760	100.0%
Total Revenues	**53,300**	**51,807**	**51,807**	100.0%
Telescope Ops	24,149	22,495	13,183	58.6%
Development	6,249	7,800	3,974	50.9%
Science Ops	6,783	7,157	10,231	143.0%
Admin Services	9,994	9,671	10,830	112.0%
Director's Office	3,617	3,231	5,189	160.6%
Education & Public Outreach	698	694	561	80.8%
FY19, Total	**51,490**	**51,048**	**43,968**	**86.1%**
FY19 CSA-A Net	**1,810**	**759**	**7,839**	

- Expenses do not include open commitments.

CSA-A FY2019 Balance Management

All Funds

Year-End Carryover Analysis ($k)		
Description	**FY19 Sources**	**FY20 Revised Budget**
Development Balance	3,772	3,772
JAO Underspend	2,689	
NA Ops Underspend	3,805	
NRC/ASIAA Funding	(2,920)	
JAO Fwd-Funded Projects	492	426
Special Projects in Chile		1,228
Multicancha Reserve		2,151
ICC Reserve		262
Total FYE Carryover	**7,839**	**7,839**

CSA-A Canadian Funds @ NSF 9/30/19

Canadian Balance at NSF	Amount $k
CY14 Q2 & Q3	679
CY2014 Q4 & CY15 Q1	742
Passthru (CSA-2 Amd. 33)	(1,115)
CY15 Q2 & Q3	683
CY15 Q4 & CY16 Q1	546
CY16 Q2 & Q3	548
CY16 Q4 & CY17 Q1	738
CY17 Q2 & Q3	587
CY17 Q4 & CY18 Q1	715
CY18 Q2 & Q3	785
CY18 Q4 & CY19 Q1	649
CY19 Q2 & Q3	779
TOTAL	**6,335**

CSA-L FY2019 Final (10/25/19)

- Admin services reflects reclass of expenses from telescope ops.
- Carryforward includes reobligation of LBO funding from CSA-1.
- Balance will be used in support of VLBA capital projects and reserve for ICC.

	FY19 POP Budget	FY19 Rev. Budget	FY19 YTD Expenses	FY19 % Rev Budget
NSF	3,430	3,430	3,430	100.0%
Telescope Time Sales	4,439	4,439	4,491	101.2%
Carryforward	0	31	361	
Other	285	285	24	8.4%
Total CSA-L Revenues	**8,154**	**8,185**	**8,306**	101.5%
Telescope Ops	6,157	6,062	4,874	80.4%
Development	0	0	0	
Science Ops	1	1	1	100.0%
Admin Services	1,470	1,565	2,204	140.8%
Director's Office	526	526	433	82.3%
Education & Public Outreach	0	0	0	
FY19, Total	**8,154**	**8,154**	**7,512**	**92.1%**
FY19 CSA-L Net	**0**	**31**	**794**	

CSA-S F & H FY2019 Final (10/25/19)

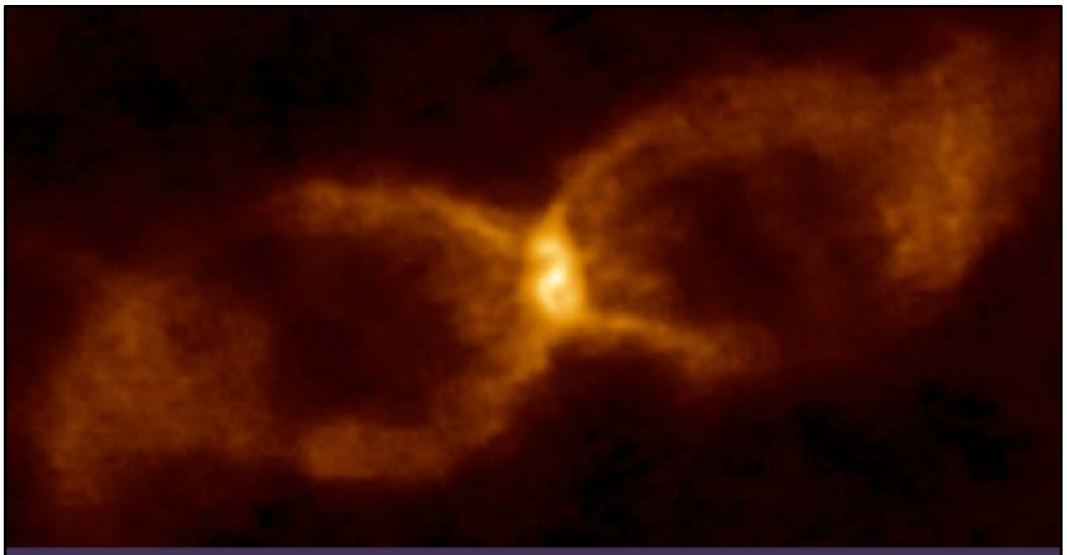
	CSA H Budget	ITD Expenses	% Budget	CSA-F Budget	ITD Expenses	% Budget
NSF	2,000	1,944	97.2%	2,500	822	32.9%

- CSA-H: St. Croix work complete. Some additional charges for ICC.
- CSA-F: Installation work substantively complete. Eight of ten sites connected, remaining two to complete in December. Balance to fund operating charges through FY2021.

ICC FY2019 Final (10/25/19)

- Recoveries low due to universal underspending.
- Expenses $850K under budget: breakage, fringe savings, shutdown.
- Under-recovery of $760K. Expeditious approval of FY2019 final rates needed.

	FY19 POP Budget	FY19 Rev. Budget	FY19 YTD Expenses	YTD % Rev Budget
NRAO Recoveries	15,176	15,176	13,390	88.2%
External Recoveries	1,412	1,412	1,404	99.4%
Total ICC Revenues	**16,588**	**16,588**	**14,794**	89.2%
Telescope Ops	108	109	124	113.8%
Development	462	464	472	101.7%
Science Ops	2,567	2,605	2,508	96.3%
Admin Services	11,450	11,247	10,699	95.1%
Director's Office	2,001	1,976	1,750	88.6%
FY19, Total	**16,588**	**16,401**	**15,553**	**94.8%**
FY19 ICC Net	**0**	**187**	**-759**	



QSU4 FY2019 Exception Report

Education and Public Outreach

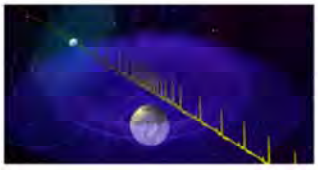
Education and Public Outreach

News: One VLA/VLBA, two NRAO

New Method May Resolve Difficulty in Measuring Universe's Expansion

July 8, 2019 at 11:00 am | News Release

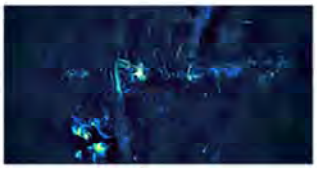
Radio telescope observations have made it possible for astronomers to use mergers of neutron-star pairs as a valuable new tool for measuring the Universe's expansion.



Most Massive Neutron Star Ever Detected, Almost too Massive to Exist

September 16, 2019 at 1:08 pm | News Release

Astronomers using the GBT have discovered the most massive neutron star to date, a rapidly spinning pulsar approximately 4,600 light-years from Earth. This record-breaking object is teetering on the edge of existence, approaching the theoretical maximum mass possible for a neutron star.



Towering Balloon-like Features Discovered near Center of the Milky Way

September 5, 2019 at 7:59 pm | News Release

An international team of astronomers has discovered one of the largest features ever observed in the center of the Milky Way – a pair of enormous radio-emitting bubbles that tower hundreds of light-years above and below the central region of our galaxy.

Education and Public Outreach

ALMA News: Two News Releases, one Announcement

Image Release: ALMA Shows What's Inside Jupiter's Storms

August 20, 2019 at 3:55 pm I News Release

New radio wave images made with the Atacama Large Millimeter/submillimeter Array (ALMA) provide a unique view of Jupiter's atmosphere down to fifty kilometers below the planet's visible cloud deck.

ALMA Dives into Black Hole's 'Sphere of Influence'

August 7, 2019 at 11:00 am I News Release

New ALMA observations provide an unprecedented close-up view of a swirling disk of cold interstellar gas rotating around a supermassive black hole.

First Canadian ALMA Large Program to Investigate the Impact of Galaxy Environment on Star Formation

September 18, 2019 at 10:00 am I Announcement

The first ever Canadian-led Atacama Large Millimeter/submillimeter Array (ALMA) Large Program has been approved for cycle 7. Dr. Brown and his colleagues will use the Atacama Compact Array (ACA) to study the influence of galaxy environment on star formation in the Virgo Cluster.

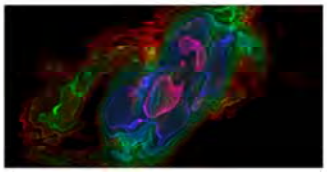
Education and Public Outreach

News: Two ALMA Feature Stories

'Moon-forming' Circumplanetary Disk Discovered in Distant Star System

July 11, 2019 at 2:00 pm | News Feature

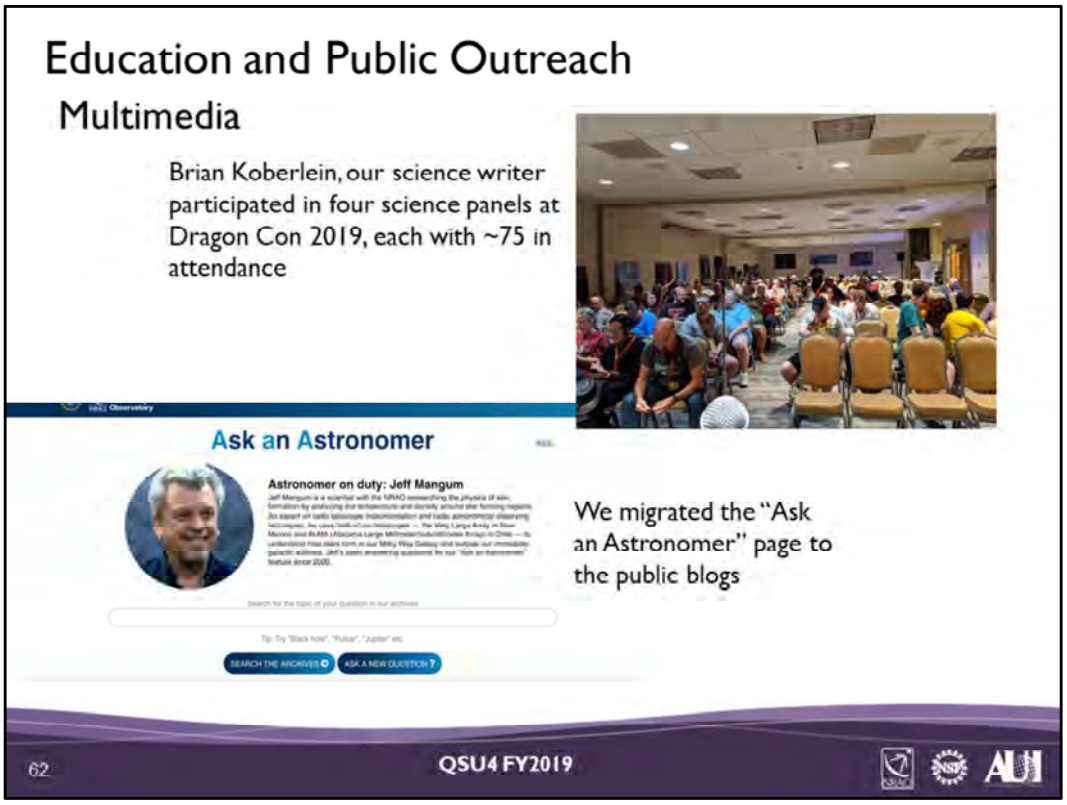
ALMA has made the first-ever observations of a circumplanetary disk.



From Cells To Galaxies And Beyond

September 25, 2019 at 11:48 am | News Feature

The methods used in medical imaging and radio astronomy have many similarities. A group of scientists want to build on those similarities in the cells to galaxies project.



Brian Koberlein, our science writer participated in four science panels at Dragon Con 2019, each with ~75 in attendance:

- Astrochemistry to AstroBiology to SETI
- Multimessenger Astronomy: Neutrinos, Gravitational Waves and Cosmic Rays
- Imaging the M87 Black Hole
- Gaia, Sloan, VLASS, PanStarrs, Etc.: What We Learn From All-Sky Surveys.

In response to a meeting hosted by NAASC, a series of ALMA discovery posters were created and promoted through social media. They are available for free download https://public.nrao.edu/gallery/infographics-and-posters/

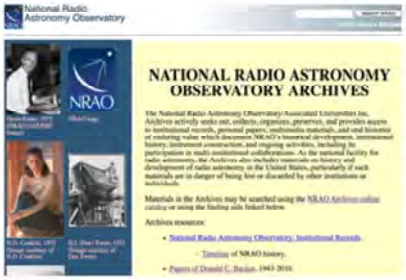
Education and Public Outreach

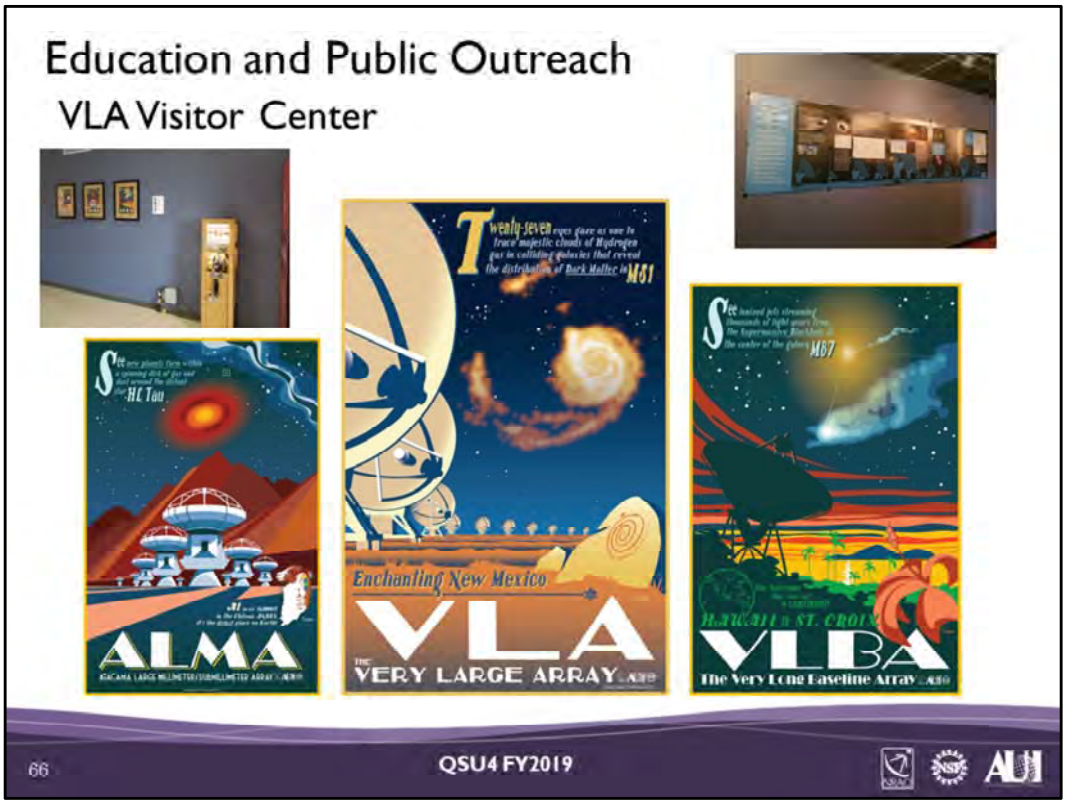
Multimedia

Dozens of Tweets during #blackholeweek

Education and Public Outreach

Multimedia: Works in progress





The visitor center got a facelift, after patching and painting the entry and wall where EVLA posters were, we have a clean entry with the new Tyler Nordgren Posters for sale and ngVLA as a representation for our future.

Education and Public Outreach

STEAM Ed @ Visitor Center

- 1682 Visitors
- Averaged 170 in attendance on First and Third Saturdays
- 231 in 7 special tours

7/6/2019	First Saturday	295
7/7/2019	REU Tours (Tiffany & Jacquie)	108
7/9/2019	Summer Science Program Tour	42
7/12/2019	UNM STEM University Tour	13
7/13/2019	REU Tours (Katherine & Mulan)	81
7/14/2019	REU Tours (Katherine & Mulan)	82
7/19/2019	Apollo 11: 50 Anniversary Celebration	N/A
7/20/2019	Third Saturday	175
7/21/2019	REU Tours (Josh & Kelly)	74
7/27/2019	REU Tours (Tiffany, Jacquie, & Josh)	88
8/2/2019	Los Lunas Public Library Tour	24
8/2/2019	New Mexico Tech Tour	55
8/3/2019	First Saturday	175
8/17/2019	Third Saturday	102
8/29/2019	Adventure Caravans Tours	40
9/7/2019	First Saturday	130
9/14/2019	Sun Tours Tour	40
9/21/2019	Third Saturday	141
9/22/2019	NM Natural History Museum Tour	17
		1682

On July 19, at 6 PM, EPO Public Information Officer Dave Finley gave a talk at Macey Center on behalf of the Civil Air Patrol to celebrate the 50th Anniversary of the Apollo 11 launch and moon landing. EPO, NRAO, and NINE student, respectively, Suzy Gurton, Summer Ash, Faith Vowler, Anja Fourie, and Heather Cochrane attended this event. During the reception after the talk, from 7:45 to 8:15 PM, Summer and Faith staffed the NRAO table, using the red & blue glasses activity to draw in visitors. They gave VLA rack cards, "Want More VLA cards," and NASA stickers to visitors who came to their table. Between 20-30 people engaged with STEAM Ed. staff at NRAO table.

On Thursday, September 5th, Jessica Harris spent all day at Burley Middle School and spoke to about 120 students in 4 different classes. Students learned about the VLA and ALMA. They explored creating their own colorized images by using the Colorizing App.

NRAO

science.nrao.edu
public.nrao.edu
ngvla.nrao.edu

The National Radio Astronomy Observatory is a facility of the National Science Foundation operated under cooperative agreement by Associated Universities, Inc.