

# National Radio Astronomy Observatory

# Quarterly Status Update (QSU) 3 FY2020

# April - June 2020

PREPARED BY	ORGANIZATION	DATE
Thisdell/ADs	Director's Office	8/5/2020

APPROVALS (Name and Signature)	ORGANIZATION
Nicole Thisdell	NRAO
Tony Beasley	NRAO
Dave Curren	AUI

			QI Per	formance Asse	essment	Q2 Per	formance Asse	ssment	Q3	Performance Asses	sment
POP	Milestone	Completion	Cost	Schedule	Scope	Cost	Schedule	Scope	Cost	Schedule	Scope
2.5	NA ALMA Operations	Date									
2.5	Operations										
I	Investigate logistics and feasibility for interferometric workshops	3/30/2020									
2	Review conference applications										
2	Special ALMA Session at AAS Winter 2020 meeting	6/30/2020									
4	Participate and Sponsor ISMS	6/30/2020									
5	Participate and Execute SISS	6/30/2020									
6	Coordinate planning and execution for Cycle 8 APR	6/30/2020								Cancelled	
	Development										
7	FY2021 (Cycle 8) Call for Study Proposals	3/30/2020									
	Chile Office	12/21/2019						_			
9	Power options for Parque Astronómico Atacama and ALMA	3/30/2020									
		6/30/2020									
10	Office lease alternatives for OCA	12/31/2019									
	IT involvement in STEM education and diversity programs	6/30/2020									
13	Plan to improve maintainability of AOS technical building	12/31/2019									
		3/30/2020									
14	Management of FEHV warranty	3/30/2020									
		12/31/2019									
15	Multicancha project – delivery and inauguration	3/30/2020									
		6/30/2020									
		12/31/2019									
16	Collective bargaining	3/30/2020									
		2/3 /2019									
17	STEM EPO and D&I	3/30/2020									
		6/30/2020									
3.3	New Mexico Operations										
	Very Large Array										
	Operations	12/21/2010									
2	Define VLA GO and SRO capabilities to be offered for Semester 2020B	6/30/2020									
3	Update VLA documentation to support 2020B Call for Proposals, perform proposal technical reviews	3/30/2020									
5	Determine baselines and pointing for antennas moving into their D configuration locations	12/31/2019									
6	Determine baselines and pointing for antennas moving into their C configuration locations	3/30/2020									
7	Determine baselines and pointing for antennas moving into their B configuration locations	6/30/2020									
8	Reconfigure from A to D configuration	12/31/2019									
9	Reconfigure from D to C configuration	3/30/2020									
10	Reconfigure from C to B configuration	6/30/2020	-								
12	Development	6/30/2020									
13	Realfast operational with VLASS epoch 2 observing	6/30/2020	1								
	Maintenance and Renewal										
16	WIDAR power system replacement	6/30/2020									
19	Perform preventive maintenance on each of two transporters prior to array reconfiguration to D	12/31/2019									
20	Perform preventive maintenance on each of two transporters prior to array reconfiguration to C	3/30/2020									
21	Perform preventive maintenance on each of two transporters prior to array reconfiguration to B	6/30/2020									
25	to D	12/31/2019									
26	Perform preventive maintenance on the next configuration VLA antenna transformers prior to array reconfiguration	3/30/2020									
	to C										
27	to B	6/30/2020									
	Technical Upgrades and Enhancements										
36	P-band polarization observations to SRO	3/30/2020									
40	Integrate VFD cryogenics system for lab testing	6/30/2020									
	Very Long Baseline Array Obsertions										
43	Define VLBA GO and SRO capabilities to be offered for semester 2020B	12/31/2019									
44	Define VLBA GO and SRO capabilities to be offered for semester 2021A	6/30/2020									
45	Update VLBA documentation to support 2020B Call for Proposals, perform proposal technical reviews	3/30/2020									
47	Implement VLBA user help program	3/30/2020									
48	Evaluate pySCHED	3/30/2020									
50	VLA/VLBA technical managers assume full administration of the JIRA-based maintenance tracking system	3/30/2020									
	Development										
51	Deliver production proposal for Oryx rollout to all VLBA sites	3/30/2020					Cancelled				
53	Initial development of network performance diagnostic tool	3/30/2020									
54	E-transfer of VLBI data from VLBA sites to DSOC correlator	6/30/2020									
	Maintenance and Renewal	(100)0000									
55	riajor maintenance visit #1	6/30/2020									
58	4 Gbps observing promoted from SRO to GO	3/30/2020									
59	YI promoted from RSRO to SRO	3/30/2020									
62	Finalize design of production E-rack power supply	3/30/2020									
4.3	Central Development Laboratory										
	Operations	12/21/2019									
1	Build and test Band 1 cryogenic amplifiers	3/30/2020									
		6/30/2020									
2	Build and test ALMA Band 1 local oscillators	12/31/2019									
		6/30/2020									
	Development	0/20/2022									
3	Design Band 6V2 IND/AIN/IND SIS MIXER	9/30/2020								Cancelled	
6	Design OMT with band gap structure	6/30/2020								Cancelled	
7	Implement polarization processing with W-band Front End	6/30/2020									
9	Initiate transmission-line reflectionless filter development with collaborator	3/30/2020									
	Maintenance Renewal, and Warranty Claims										
	V/ A/V/ DA multichia and the summer of	12/31/2019									
	VLA/VLBA multichip module support	3/30/2020									
5.7	Science Support and Research	6/30/2020									
5.7	TAC										
I	CfP for Semester 2020B	3/30/2020									
2	SRP and Tech Review, Semester 2020B	3/30/2020									
5	TAC Meeting, Semester 2020A	12/31/2019									
6	Update SW requirements for TAC 2020A	6/30/2020									
8	Update SW tools requirements for PST 2020B	3/30/2020									
9	Update SW requirements for TAC 2020B	6/30/2020									
	Update documentation for CfP 2020B	3/30/2020									
13	Extra-large proposal outcomes	6/30/2020									
	science Ready Data Products										

			QI Per	formance Asse	essment	Q2 Per	formance Asse	essment	Q3	Performance Assess	sment
POP	Milestone	Completion	Cost	Schodulo	Scono	Cost	Schodulo	Scono	Cost	Schodulo	Scono
Milestone	Milescone	Date	Cost	Schedule	Scope	Cost	Schedule	Scope	Cost	Schedule	Scope
14	Wave-I SRDP operations	12/31/2019									
15	SRDP Wave-2 capabilities and requirements	12/31/2019									
16	TTA Tools Conceptual Design Review	12/31/2019									
17	VLASS product delivery schedule	3/30/2020									
18	VLASS Epoch 2.1 Observations begin	6/30/2020									
	Scientific User Support										
19	Community Day Event program finalized	6/30/2020								Cancelled	
20	Synthesis Imaging Workshop	6/30/2020									
21	NM Symposium	12/31/2019									
22	CASA validation	3/30/2020									
23	CASAGuides	3/30/2020									
	Reference Services										
26	NRAO history book published - Development of U.S. radio astronomy	3/30/2020									
	Scientific Staff and Jansky Fellows										
27	SciStaff performance reviews	12/31/2019									
28	SciStaff promotion reviews	3/30/2020									
29	Five-year reviews	3/30/2020									
30	Jansky Lectureship awarded	6/30/2020									
31	Jansky Fellows selection completed	12/31/2019									
32	Jansky Fellows appointments completed	3/30/2020									
	Student Programs										
33	Summer student selection and offers	3/30/2020									
34	Student Observing Support selection (VLA)	12/31/2019									
35	Student Observing Support selection (VLA)	6/30/2020									
37	Reber predoc selection	3/30/2020									
6.6	Data Management and Software										
	SIS										
	Lustre and Cluster OS upgrades in NM	3/30/2020									
2	Persistent Storage for NAASC and NM	6/30/2020									
3	Evaluation of ICRAR NGAS	3/30/2020									
4	Investigate HTCondor for local VLASS operations	12/31/2019									
5	Investigate HTCondor for SRDP/VLA pipeline ops	3/30/2020									
6	Investigate remote VLASS processing on OSG	6/30/2020									
8	Completion of VLBA fiber project	3/30/2020									
	ALMA Systems Software										
10	ALMA Cycle 8 Release	12/31/2019									
	ALMA Cycle 9 Pre-Release	6/30/2020									
12	ALMA Correlator Data Rate Testing	6/30/2020									
	New Mexico Systems Software										
15	VLA/VLBA Observing Support for Semester 2019B	3/30/2020									
17	VLA/VLBA Commissioning Support for Semester 2020A	3/30/2020									
19	Support hardware/CBE Upgrade	3/30/2020									
20	Support RHEL Upgrade	3/30/2020									
21	RFI Excision in WIDAR	9/30/2020									
23	VLBA Network Performance Monitoring Tool	9/30/2020									
	CASA										
25	CASA 5.7/6.1 Release	3/30/2020									
27	CARTA Release	6/30/2020									
28	CASA NGI CDR	6/30/2020								Cancelled	
	CASA Testing										
29	CASA Testing Redesign	6/30/2020									
	CASA Pipeline										
30	Pipeline C7/SRDP Release	12/31/2019									
32	Pipeline Python 3 Planning	12/31/2019									
	Science Support and Archives										
33	Archive Retirement	6/30/2020									
34	PST Updated for Semester 2020B	12/31/2019									
35	PST Updated for Semester 2021A	6/30/2020									
36	OPT Updated for Semester 2020A	12/31/2019									
37	OPT Updated for Semester 2020B	6/30/2020									
38	PHT Updated for Semester 2020B TAC	3/30/2020									
40	SRDP-Wave-1	12/31/2019									
42	TTA Tools CoDR Support	12/31/2019									
7.5	Program Management Department										
	PMD Operations										
		12/31/2019									
1	HQ PM/SE Project Leadership	3/30/2020									
		6/30/2020									
		12/31/2019									
2	NM PM/SE Project Leadership	3/30/2020									
ļ		6/30/2020									
		12/31/2019									
3	CDL PM/SE Project Leadership	3/30/2020									
		6/30/2020									
	rroposal Development										
		12/31/2019									
4		5/30/2020									
		6/30/2020									
E	NM Proposal Development	3/20/2020									
, s		5/30/2020									
		6/30/2020									
,		12/31/2019									
6	CDL moposar Development	5/30/2020									
	DAA Activities	6/30/2020									
	i macuviues	12/21/2010									
7	HQ Continuing Education	6/30/2020									
0	NM Continuing Education	3/20/2020									
0		3/30/2020									
7		5/30/2020									
	Program Management Software Decision	12/21/2010									
10		12/31/2019									
	rrogram Management Software Implementation	6/30/2020									
12		12/31/2019									
3		3/30/2020									
		12/31/2019									
15	VLBA Fiber Installation Complete	12/31/2019									
16	VLBA Fiber Final Report	3/30/2020	<u> </u>								
17	VLBA St. Croix Repairs Complete	6/30/2020		ļ							
19	Band 1 LNA Production Complete	3/30/2020									
8.5	Education and Public Outreach										
	News and Public Information										
		12/31/2019									
	identity potential image or story to feature	3/30/2020									
		6/30/2020									
2	Reserve room with AAS	3/30/2020		<b> </b>							
3		3/30/2020									
4	Denne promotional materials for Astronomers	12/31/2019									
	Estaviisti Calenual allu Cultacts IOF UESKSIUE DEIEIINgs	12/31/2019									
1		3/30/2020	1	I	I						

			QI Per	formance Asse	essment	Q2 Per	formance Asse	ssment	Q3	Performance Assess	sment
POP		Completion						•			-
Milestone	Milestone	Date	Cost	Schedule	Scope	Cost	Schedule	Scope	Cost	Schedule	Scope
	Contact reporter for briening	6/30/2020								Cancelled	
	Multimedia Team										
7	Define menu of press product image options	12/31/2019									
8	Determine specifications for Gallery	12/31/2019									
		12/31/2019									
10	Identify topic for hosted video	3/30/2020									
		6/30/2020									
		12/31/2019									
П	Complete assignments for hosted video	3/30/2020									
		6/30/2020									
12	Define format and develop procedure for populating style guide	12/31/2019									
14	Create AR beta application and web plugin	6/30/2020									
	STEAM Ed										
15	San Pedro Cohort orientation	12/31/2019									
16	NM Cohort orientation	3/30/2020									
17	Identify new content for outreach booth	6/30/2020									
18	Identify National Association for Interpreters workshops for certified trainers	3/30/2020									
	VLA VC Operations										
20	Survey advertising options	12/31/2019									
9.4	Computing and Information Services										
	Observatory-Wide Support										
I	Upgrade of Mac platform to Mojave	12/31/2019									
2	Albuquerque office connectivity	3/30/2020									
3	Cyber Security risk assessment	12/31/2019									
4	Security Controls and Log Management	6/30/2020									
6	Information Privacy Policy release	12/31/2019									
7	Non-employee account audit	3/30/2020									
8	Application Whitelisting	6/30/2020									
	Site Specific Facilities Infrastructure										
10	VLA CBE and network upgrade	3/30/2020									
11	Local area network upgrades at the NAASC	6/30/2020									
	Maintenance and Renewal										
10.2	Office of Diversity and Inclusion										
	Local and National Programs										
		12/31/2019									
I	Diversity Council quarterly meetings	3/30/2020									
		6/30/2020									
2	NAC and LSAMP Recruitment	3/30/2020									
		6/30/2020									
5	RADIAL Project Plan and Proposal completed	3/30/2020									
		12/31/2019									
6	Diversity and Cultural Awareness training offered	3/30/2020									
		6/30/2020									
	International Partnerships										
7	Chile REU program recruitment completed	12/31/2019									
8	Chile REU program completed	3/30/2020									
11.7	Human Resources										
	Workforce Management										
		12/31/2019									
I	ngVLA Hiring	3/30/2020									
		6/30/2020									
		12/31/2019									
2	GBO Five-Year Proposal Workforce Management Plan	3/30/2020									
		6/30/2020									
	Training and Development										
3	Observatory Leadership Cohort Pilot Assessment/Implementation plan	12/31/2019									
4	How to Travel as an Observatory Employee Training Module	3/30/2020									
5	Bullying Prevention – Online Training	6/30/2020									
	Compensation										
6	Enhance Online Marketing Pricing Tool	12/31/2019									
7	Finalize Variable Pay Plan	12/31/2019									
		10/01/02/2									
10		12/31/2019									
10	Electronic enrollment - Non open enrollment benefit entry	3/30/2020									
		6/30/2020									
	Third Party Panefits Vandar Unland Pressurtion	2/20/2020									
		5/30/2020								Cancelled	
10	Work with Aon to research Retires Medical Plan for Children ISMs	3/20/2020									
12	Recruitment Employment	5, 50, 2020									
13	lobvite Enhancements	3/30/2020									
4	Hiring Manager Training Design	3/30/2020									
15	Hiring Manager Training Delivery	6/30/2020	1								
16	Background and Credit Check for Specific Positions	3/30/2020	1								
	HR										
17	FY2019 Climate Survey Results Initiatives	12/31/2019									
18	Bi-Weekly Payroll Transition	3/30/2020									
12.2	Science Communications										
I	Redesign NRAO exhibits	12/31/2019									
2	Publish 2020 Research Facilities brochure	3/30/2020									
3	Submit AAAS science symposium proposal	6/30/2020								Cancelled	
13.6	Administration										
	Administration										
2	Updated job descriptions	6/30/2020									
	ESS										
5	Develop Security Plan	3/30/2020								Cancelled	
6	Cost security recommendations	6/30/2020								Cancelled	
	MIS										
7	Bi-Weekly ETK Entry Enhancements	12/31/2019									
8	Exempt Staff Transition from Monthly to Bi-Weekly payroll	3/30/2020									
9	Implement Employee Benefits On-Boarding workflow	3/30/2020									
	тто										
10	C2G 2020 planning complete	6/30/2020									
	C2G 2020 commence workshop	6/30/2020								Cancelled	
14.1	Budget										
	Hire Jr. Business Systems Analyst	12/31/2019									
		12/31/2019									
2	Implement FY2020 Budget	3/30/2020									
-		6/30/2020									
3	Update travel budget guidance	6/30/2020									
4	Insurance broker rebid process	3/30/2020									
5	2020 Insurance renewal	12/31/2019									
6		3/30/2020									
7		6/30/2020	-								
9		3/30/2020									
	Evaluate JDE Position Control module	6/30/2020									
12	Revised budget structure for paid time off	3/30/2020									
15	Spectrum Management	0/ 30/ 2020									
13.3											

			QI Per	formance Asse	essment	Q2 Per	formance Asse	ssment	Q3 Performance Assessment		
POP	Milestone	Completion	Cost	Sahadula	Scono	Cost	Sehedule	<b>S</b> eene	Cost	Sahadula	Scono
Milestone	Milestone	Date	Cost	Schedule	Scope	Cost	Schedule	Scope	Cost	Schedule	Scope
I	WRC-19, Sharm El-Sheik	12/31/2019									
2	WP 7D, Geneva	6/30/2020								Cancelled	
3	Other ITU-R Working Parties	6/30/2020									
16.2	Director's Office										
	ALMA										
		12/31/2019									
		6/30/2020									
2	ALMA Director's Council	3/30/2020									
	Corporate Meetings										
		12/31/2019									
3	AUI Board of Trustee Meeting	3/30/2020					Cancelled				
		6/30/2020									
		12/31/2019									
4	AUI Executive Committee Meeting	3/30/2020									
		6/30/2020									
5	AUI Visiting Committee Meeting	6/30/2020								Cancelled	
	Science Community										
6	Appoint new Users Committee Members	12/31/2019									
7	Users Committee Meeting	6/30/2020									
	Management Reviews										
8	NSF Annual Program Review	12/31/2019									
9	All-Hands Meeting	3/30/2020									

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#### QSU1 FY2020





COST:	ing opens								
Labor Actuals  S Material Actuals  Travel Actuals  S	Expected \$ Expected \$ Expected \$		No change in scope.To FY2021 due to COVIE	No change in scope.Tentatively rescheduled for FY2021 due to COVID-19.					
SCHEDULE:				RISK & MITIGATION:					
Milestone	Schedule	Target	Risk	Mitigation					
I. Participate and Sponsor the 2020 ISMS conference	Q3 FY2020	Q3 FY2021	<ol> <li>Due to the spread of COVID-19, the conference was delayed a year</li> </ol>	<ol> <li>Funds were still spent to offset the costs of the conference in FY2020 but the actual f2f conference was delayed until FY2021</li> </ol>					

COST: No change in cost at this time. Budget spent to offset existing/running costs

SCOPE: No change in scope at this time.

SCHEDULE: Cancelled in FY2020 and tentatively moved meeting to FY2021.

RISK & MITIGATION: All face-to-face meetings cancelled in FY2020 Q3 and Q4 to minimize/slow spread of COVID-19. Though meeting is tentatively scheduled for Q3 FY2021, the situation will need to be reassessed in Q1 and Q2 of 2021 to see if a face-to-face meeting is even possible in Q3 of FY2021.

Coordinate P COST:	lanning a	and Exec	scope:	APR			
Labor Actuals	Expected		Milestone cancelled.				
♥ Material Actuals \$	Expected		Due to COVID-19 this milestone was cancelled as the new Cycle 8 CfP will utilize a				
Travel Actuals	Expected \$		new proposal review process.				
SCHEDULE:			RISK & MITIGATION:				
Milestone	Schedule	Target	Risk	Mitigation			
<ol> <li>Coordinate planning and Execution for the Cycle 8 APR</li> </ol>	Q3 FY2020	None	I. Due to the spread of COVID-19 the ALMA Cycle 8 CfP was suspended for a year	<ol> <li>APRC meeting cancelled; no expenses were incurred.</li> </ol>			

COST: No change in cost at this time. No budget spent

SCOPE: Due to COVID-19 this milestone was cancelled as the new Cycle 8 CfP will utilize a new proposal review process.

SCHEDULE: Cancelled in FY2020.

RISK & MITIGATION: All face-to-face meetings cancelled in FY2020 Q3 and Q4 to minimize/slow spread of COVID-19. The ALMA proposal call was suspended for a year and will utilize a new proposal review process.

F		сто	NE # 2	2.5.14	Cost					
	NRAO-Chile	Office			Schedule					
	Management	of Warra	anty for FI	EHV	Scope					
	COST:			SCOPE:						
	Labor Actuals	Expected		The Front End Handlin	The Front End Handling Vehicles (four) were					
	\$			delivered to the OSF a	and conditionally					
	Material Actuals			accepted by the JAO in Q2. Pending actions include documentation and resolution of minor workmanship issues; these will be addressed once observatory operations resume after the pandemic.						
	\$									
	Travel Actuals									
	\$									
	SCHEDULE:			RISK & MITIGATION:						
	Milestone	Schedule	Target	Risk	Mitigation					
	I. Mgt of warranty issues	Q2	N/A	1. Uncertainty about resumption of operations	I. Must assume risk, cannot mitigate					
				2. Deterioration of idle vehicles (due to lack of use)	2. Caretaker Team members to run the vehicles monthly					
5			QSU3 F	¥2020		1				

COST: No additional costs are foreseen. Associated costs (staff time and travel) remain the same.

SCOPE: This milestone assumed that the FEHV had already been fully accepted by Q2 and therefore focused on management of any warranty issues. These issues can only be addressed once the vehicles are fully accepted and are being used by the JAO.

SCHEDULE: In the midst of the covid-19 pandemic, it is very difficult to estimate a new target date for full acceptance.

RISK & MITIGATION: In addition to the uncertainty about resumption of observatory operations, the deterioration of idle vehicles due to lack of use was listed as a concern in the QSU2. The mitigation for this risk has been to run the vehicles monthly; this is being done by the caretaker team.

	вто	NE # 2	2.5.15	Cost				
NRAO Chile	Office			Schedule				
Multicancha p	roject –	delivery	and inauguration	Scope				
COST:			SCOPE:					
Labor Actuals	Expected \$		Construction and delivery of an indoor					
\$			sports facility for ALN	1A observatory staff				
Material Actuals	Expected		use at the OSF.					
\$	\$ Expected \$		Due to COVID-19, work on the construction site has been suspended since March.					
Travel Actuals								
\$								
SCHEDULE:			RISK & MITIGATION:					
Milestone	Schedule	Target	Risk	Mitigation				
I. Delivery/inauguration	Q1-Q3	N/A	I. Cost of suspension	I. Reduction in standing army costs				
	1		2. Schedule	2. Backup plans to face possible interruptions once observatory reopens				
		QSU3 F	¥2020	🖾 🎯 州				

COST: At the time of the Q2 re-baselining, the available budget would have been sufficient to finish the project. As a result of COVID-19, the contractor has not been able to resume work since March, adding substantial standing army costs. AUI-NRAO continues to pay part of contractor staff salaries, as well as the equipment rental that was left at the site. A full assessment of the cost-to-complete will be made once the date of construction restart is known.

SCOPE: The scope of the project remains the same as originally planned.

SCHEDULE: In March, the re-baselining exercise projected the time to complete was 7-8 months. Currently, significant uncertainties exist regarding the OSF restart date, contractor access to the site and ability to continue work without interruptions once observatory reopens.

#### **RISKS & MITIGATION**

I. COST OF SUSPENSION: - Magnitude of suspension costs depends on how long it takes to resume work. - Long-term exposure of critical materials (e.g. wooden beams) could add to the suspension costs. MITIGATION: - As a result of negotiations with the contractor, monthly costs have gone down by 36% with respect to Q2 (CLP96m to CLP61m / USD125k to 80k). - Although critical materials were wrapped and protected before demobilization, the unexpected length of the suspension has left little room for further mitigations.

2. SCHEDULE risk is related to uncertainties in: Restart date; Continuity of work after restart; Impact of covid-19 safety adaptations and/or setbacks caused by contagion among contractor workers. MITIGATION: Little control over restart timeline; Work on backup plans to gain some independence from JAO in case of interruptions; Development of covid-19 safety protocols. Impact on schedule is estimated at 10%-20%.

REDUCED/RETIRED RISKS (with respect to QSU2 report): - TECHNICAL risks associated with the integration of interfaces and constructive procedures have been reduced thanks to detailed analysis, review and cross-examination of specialties and drawings. New designs, corrections and improved integration plans are now documented and will be incorporated in future works. - SCHEDULE risk due to poor planning has been lowered by including all remaining activities and their corresponding resource allocations in comprehensive Gantt chart. - PROJECT CLOSEOUT risk is no longer deemed critical, after thorough legal analysis was conducted.

POP MILI NM Operations VLA technical n maintenance an COST	ESTO nanager ass d overhaul	NE # 3 sumes sched s for the VL	<b>.3.12</b> Iuler duties for A and the VL	or major BA			
Labor Actuals There are no chan	Labor Actuals Expected There are no changes in budget.			nical Manager is to take over ies for major maintenance and the VLA and VLBA from the ions Division Head during Q3.			
SCHEDULE:			RISK & MITIGATION:				
Milestone	Schedule	Target	Risk	Mitigation			
<ol> <li>Scheduling of major maintenance</li> </ol>	6/30/2020	9/30/2020	I. None	1. None needed			
	_	QSU3 F1	(2020				

COST: No change.

SCOPE: No change.

SCHEDULE: Training on the scheduler duties for the VLA Technical Manager was delayed by the need for the Technical Manager to perform other training for newly hired staff, and inefficiencies associated with working from home during the Infectious Disease Operating Status. The training on scheduler duties will now be finalized by the end of Q4.

RISK & MITIGATION: There are no risks associated with the delay in schedule.



COST: See description in four-square.

SCOPE: See description in four-square.

SCHEDULE: Deadline of 4/30/2020 was missed. Completion of project in August 2020.

RISK & MITIGATION: No technical risk. See description in four-square.

	ESTO	NE # 4	.3.2	Cost			
Central De Build and Tes	velopmei st Band I	nt Labora Local Osc	tory illators	Scope			
COST:			SCOPE:				
Not Applicable.			This is a multi-year batches as per an ag Qty. 15 LO articles completion was dela resulting from the O The batch has now final batch required end of the year is ex	contract with staged deliveries of greed upon schedule. A batch of were due in May 2020, but ayed due to the work slowdown Dbservatory's pandemic response. been completed (July 2020). The to close out the project by the spected to be on schedule.			
SCHEDULE:			<b>RISK &amp; MITIGATION:</b>				
Milestone	Schedule	Target	Risk	Mitigation			
<ol> <li>Build and Test Band I Local Oscillators</li> </ol>	(Original) Part completion deadline in May 2020.	Completed July 2020.	I. Not Applicable.	I. Not Applicable.			
		QSU3 FY	72020				

COST: See description in four-square.

SCOPE: See description in four-square.

SCHEDULE: Batch deadline of May 2020 was missed, but completed subsequently. Completion of project expected to be on time by Nov 2020.

RISK & MITIGATION: No technical risk. See description in four-square.

	ESTC	<b>DNE</b> # 4	1.3.3		Cost	
Central De	evelopme	ent Labora	atory		Schedule	
Design Band 6	v2 Nb/AIN	I/Nb Mixer	2.50		Scope	
COST:			SCOPE:		As of 7/28/2020	
This effort was par ALMA Developmen Superconducting C generation of Band capability".	This effort was part of the FY2020 UVa-NRAO ALMA Development Proposal for Superconducting Circuits."Develop next generation of Band 6 Nb/AL-oxide/NB SISI mixer capability".			Find a SIS-junction design that meets performance spec in simulation with NRAO-designed mixer circuit and acquire a mask set (photomask) for fabrication of these mixers.		
SCHEDULE:	SCHEDULE:			<b>RISK &amp; MITIGATION:</b>		
Milestone	Schedule	Target	Risk	Mitigation		
Design the Band 6v2 mixer optimized for low, flat noise across the IF band. Acquire mask set for production.	(Original) 9/30/2020	Completed in July 2020.	N/A			
		QSU3 F	¥2020			

#### NOTES ARE REQUIRED FOR EACH 4-SQUARE REPORT

COST: No change.

SCOPE: No change.

SCHEDULE: Completed ahead of schedule.

RISK & MITIGATION: No risk.

COST:			SCOPE:		
Labor Actuals	Expected		RE design-work for	this feed was	
\$	\$		RF design-work for this feed was completed, a plywood mockup was built to test form-factor, clearance etc. Wind loading analysis was also performed and feed fabrication drawings completed. GBO decided to halt feed fabrication as it is too big and could damage the structure during emergency stowing. (Change of scope/specification).		
Material Actua	als Expected				
\$	\$				
Travel Actuals	Expected				
\$	\$				
SCHEDULE	:		RISK & MITIGA	TION:	
Milestone	Schedule	Target	Risk	Mitigation	
I. Deliver tested 310 MHz feed and test data	(Original) 12/31/2019 (Revised in Q1 to 6/30/2020 and Q2 to 7/31/2020)	New milestone incorporated into POP 2021.	<ol> <li>Existing design was deemed inadequate.</li> </ol>	<ol> <li>We now have a new design where parts of the feed will break away if it ran into any obstruction. This new design will be fabricated by GBO shop and a new milestone has been incorporated in POP 2021 (scheduled for Q3 completion).</li> </ol>	

COST: Not Applicable.

SCOPE: The 310 MHz project is delayed because of two reasons. 1) the slowdown because of the observatory's pandemic response. 2) GBO halted feed fabrication as it is too big and could damage the structure during emergency stowing.

SCHEDULE: We now have a new design where parts of the feed will break away if it ran into any obstruction. This new design will be fabricated by GBO shop and a new milestone has been incorporated in POP FY2021 (scheduled for Q3 completion). Milestone cancelled.

RISK & MITIGATION: The overall 310 MHz project was a MSIP proposal (with University of Richmond) for which we had submitted a pre-proposal. In March, NSF decided to not seek a full proposal, so no follow on activity is impacted. The GBO construction of the 310 MHz antenna, however, does not depend on the MSIP award, and GBO plans to build the antenna and do live testing on the GBT.

COST:				SCOPE:		
Labor Actuals		Expected \$		Milestone cancelled.		
\$				While the study of band gap structures continued		
Material Actu	als	Expected		throughout the yea with band gap strue	r, progress on the design of an OMT cture was hampered by the work	
\$		\$		slowdown owing to	o the observatory's pandemic	
Travel Actuals	;	Expected \$		response. Request to cancel this milestone as the work is now subsumed into the effort to produce a Band 6v2 OMT design with a new milestone in POP 2021.		
\$						
SCHEDUL	E:			RISK & MITIGA	ATION:	
Milestone	Schedu	le	Target	Risk	Mitigation	
I. Design OMT with Band gap structure	6/30/202	0	New milestone incorporated into POP 2021.	I. Not Applicable.	1. Not Applicable.	

COST: Not applicable.

SCOPE: See four-square.

SCHEDULE: See four-square.

RISK & MITIGATION: Not applicable.

COST:	operati	0115	SCOPE: SCOPE:		
Labor Actuals	Expected \$ no change Is Expected \$ no change Expected		This milestone mark	ts the beginning of the	
Material Actuals			SRDP Wave I deployment, which has largely been met. Delay with software release to support the full AUDI capability has prevented declaring Pilot Operations complete.		
\$ Travel Actuals					
\$	\$no change				
SCHEDULE:			RISK & MITIGATI	ON:	
Milestone	Schedule	Target	Risk	Mitigation	
I. Commence SRDP Wave I Operations	Dec 31, 2019	7/31/2020	I. Failure to Validate	<ol> <li>Accept and issue updates if bugs are found</li> </ol>	

COST: No Impact on Cost

SCOPE: No Impact on Scope

SCHEDULE: Wave I Operations have commenced, all planned capability has been delivered. A few operational issues remain with the AUDI capability to be resolved before declaring Pilot Operations complete. The software release required to support the full AUDI capability has been delayed within DMS for a preference to support other work.

RISK & MITIGATION: The code has been in production, with ongoing bug fixes. There is still a risk for a Failure to Validate or break working code. This is mitigated with further bug fixes and repeated validation.

VLASS produ	ct delive	ry schedu	ıle	Scope		
COST:			SCOPE:			
Labor Actuals	Expected		Maintaining scientific se	Maintaining scientific scope though increase in		
\$	\$		cost and delays.			
Material Actuals	Expected		Some compromise on image quality may be required to deliver scope under cost			
\$ compute resources	\$ under eval	uation				
Travel Actuals	Expected \$		constraints.			
\$						
SCHEDULE:			<b>RISK &amp; MITIGATIO</b>	N:		
Milestone	Schedule	Target	Risk	Mitigation		
I. Product Delivery Schedule	3/31/2020	9/30/2020	1. Internal compute resources for SE imaging inadequate	I. External compute resources, CHTC is under test		
		-	2. Algorithmic risk for single epoch products	2. Engagement with ARDG/CASA		
			3. Disengagement of users community	3. Transparent communication, an expectation management		

COST: Single Epoch imaging may be considerably more expensive than predicted. External processing alternatives are being explored. The most promising is the Condo High Throughput Computing Center at the University of Wisconsin. Processing protocols to use this resource are currently under test and look very promising.

SCOPE: Overall project scope is currently maintained, but initial goals for image quality are at risk.

SCHEDULE: Generation of Single Epoch images has proven more challenging than anticipated. This is being addressed by concentrating resources on algorithm development and evaluation of external compute resources.

RISK & MITIGATION:

- Constraints on compute resources pose a risk to cost and image quality. Primary mitigation is to restructure our data format to comply with CHTC, which is available at no increase in cost. Secondary mitigation includes use of Amazon Web Services (AWS) or the Extreme Science and Engineering Discovery Environment (XSEDE).
- 2) Detailed algorithms to process the entire survey are not yet available. This uncertainty introduces risk across all project areas, including schedule, scope, cost, and quality. An algorithm under test has produced several images and is currently under evaluation for use in production.
- 3) The survey consumes significant telescope time and has experienced delays, introducing reputation risk in the user community. Mitigation of this risk includes close interaction with the Survey Science Group, announcements and data releases as early as possible, engagement at astronomy events, and transparency with the challenges this survey presents.

Labor Actuals			SCOPE	
<ul> <li>Material Actuals</li> <li>\$</li> <li>Travel Actuals</li> <li>\$</li> </ul>	Expected \$ Expected \$ Expected \$		Milestone cancelled.A since March 2020 due	ll staff travel cancelled to Covid-19 restrictions.
SCHEDULE:			RISK & MITIGATIO	N:
Milestone Community days	Schedule June 2020	Target FY2021	Risk 1. Loss of training for our user community	Mitigation I. Move user training on-line

COST: No impact.

SCOPE: No impact.

SCHEDULE: This year we would have had four Community Days (but all are cancelled/postponed):

Mexico (Guanajuato - March 10-11) Japan (NAOJ - March 31, April 1) Canada (DRAO - June3-4) Italy (IRA-INAF - September 8-9)

RISK & MITIGATION: We have continued our related training programs online, e.g. Synthesis Imaging workshop.

Data Manag Completion	gement 8 n of VLB/	Softwar A fiber pr	re/SIS roject	Schedule Scope
Labor Actuals \$ Material Actuals \$ Travel Actuals \$	Expected \$ Expected \$ Expected \$		No change in scope; a sites to be connected optic	ll 10VLBA to internet by fiber
SCHEDULE:			RISK & MITIGATIO	N:
Milestone 1. Hancock, NH 2. Los Alamos	Schedule           Q2 FY2020           Q2 FY2020	Target           Q4 FY2020           Q4 FY2020           Q4 FY2020	Risk I. Two of ten sites running over slow internet service	Mitigation I. Continue to ship disk packs and use other sites for observations needing real- time data
6		QSU3 F	÷Y2020	

COST: No impact.

SCOPE: Two of 10 sites delayed.

SCHEDULE: Two sites remain:

\* Los Alamos has NOT yet begun installation, but expected start in mid-August with TA-33 project completed this fiscal year (end of September)

\* Univ. of NH says that they started the trenching/build portion July 21: Still on track to be completed by the end of August/early September

RISK & MITIGATION: Continue to ship disk packs and use other sites for real-time observations.

Correlator Data Rate Testing         SCOPE:         Labor Actuals       Expected         DMS funds this activity at a higher WBS level.       Initial tests in Q2 FY2020 will be conducted the current system with higher data find potential bottlenecks in the software report will be produced in Q3.         \$       \$         Travel Actuals       Expected         \$       \$         SCHEDULE:       RISK & MITIGATION:         Milestone       Schedule       Target         1. Test data rates and produce test report.       6/30/2020       TBD	chedule		
Labor Actuals       Expected         DMS funds this activity at a higher WBS level.       Initial tests in Q2 FY2020 will be conducted to the current system with higher data find potential bottlenecks in the software report will be produced in Q3.         %       %       Sechedule       RISK & MITIGATION:         Milestone       Schedule       Target       Risk       Mitigation         1. Test data rates and produce test report.       6/30/2020       TBD       I. None       I. None	cope		
Material Actuals     Expected       \$     \$       Travel Actuals     Expected       \$     \$       SCHEDULE:     RISK & MITIGATION:       Milestone     Schedule       I. Test data rates and produce test report.     6/30/2020	cted to		
\$     \$     report will be produced in Q3.       Travel Actuals     Expected       \$     \$       \$     \$       SCHEDULE:     RISK & MITIGATION:       Milestone     Schedule     Target       1. Test data rates and produce test report.     6/30/2020     TBD	test the current system with higher data rates to find potential bottlenecks in the software. A test report will be produced in Q3.		
\$     \$       SCHEDULE:     RISK & MITIGATION:       Milestone     Schedule     Target       I. Test data rates and produce test report.     6/30/2020     TBD			
Milestone     Schedule     Target     Risk     Mitigation       I. Test data rates and produce test report.     6/30/2020     TBD     I. None     I. None			
I. Test data rates and produce test report. 6/30/2020 TBD I. None			

SCOPE: Initial tests in Q2 FY2020 will be conducted to test the current system with higher data rates to find potential bottlenecks in the software. A test report will be produced in Q3.

SCHEDULE: This milestone requires use of the ALMA telescope for testing. Testing is unable to proceed due to the telescope being shut down for the COVID-19 pandemic. Testing will resume after the telescope resumes operations and any operational issues are resolved.

RISK & MITIGATION: None.

POP MILE	ESTO	NE #	<b>6.5.2  </b> re	Cost Schedule		
RFI Excision				Scope		
COST:	COST:			SCOPE:		
Labor Actuals	Expected					
DMS funds this activit	y at a higher \	WBS level.	Strategies to reduce the effects of RFI on observations are being investigated, let by and in coordination with the scientific staff. The group will produce prototype software and support			
Material Actuals	Expected					
\$	\$					
Travel Actuals	Expected		testing during	testing during FY2020.		
\$	\$					
SCHEDULE:			RISK & MITI	GATION:		
Milestone	Schedule	Target	Risk	Mitigation		
<ol> <li>Deliver RFI Excision prototype software and configuration.</li> </ol>	Sep 30, 2020	Complete	I. None			
		QSU3	FY2020	🔬 🞯 州		

SCOPE: Strategies to reduce the effects of RFI on observations are being investigated, let by and in coordination with the scientific staff. The group will produce prototype software and support testing during FY2020.

SCHEDULE: Completed early.

RISK & MITIGATION: None.

COST:	ork Perto	rmance	SCOPE:			
Labor Actuals	Expected					
DMS funds this activ	vity at a higher \	NBS level.	A network per	A network performance monitoring tool will be developed and made available for deployment to all sites during FY2020 to help monitor and		
Material Actuals	Expected		developed and			
\$	\$		manage network performance.			
Travel Actuals	Expected					
\$	\$					
SCHEDULE:			RISK & MITIC	GATION:		
Milestone	Schedule	Target	Risk	Mitigation		
I. Deliver Network Performance Monitoring Tool software	Sep 30, 2020	Complete	I. None			

SCOPE: A network performance monitoring tool will be developed and made available for deployment to all sites during FY2020 to help monitor and manage network performance.

SCHEDULE: Completed early.

RISK & MITIGATION: None.

Data Manag CASA 5.7/6.	Data Management & Software CASA 5.7/6.1 Release			Schedule Scope	
COST:			SCOPE:		
Labor Actuals Expected		CASA 5.7/6.1 dual release, incorporating several			
DMS funds this activity at a higher WBS level.					
Material Actuals	5 Expected		memory consumption (tclean refactor).		
\$	\$		improvements to the VLBI fringefit task, and		
Travel Actuals	Expected		support for both the Python 2 and 3 in 5.7 and 6.1 respectively.		
\$	\$				
SCHEDULE:			RISK & MITIGATIO	N:	
Milestone	Schedule	Target	Risk	Mitigation	
I. CASA Release 5.7/6	.1   Mar 31, 2020	August 6, 2020	<ol> <li>Further slippage could impact ALMA pipeline schedule.</li> </ol>	<ol> <li>Code is finished and in testing, risk is minimal and fixes limited to blocker issues.</li> </ol>	

SCOPE: In Q3, the 5.7/6.1 dual release will be delivered, incorporating several optimizations for imaging parallelization and memory consumption, improvements to the VLBI fringefit task, and support for both the Python 2.7 5.x and the Python 3.6 6.x series of CASA. Optimizations to imaging parallelization and memory consumption were completed, but their release has been postponed to 6.2 to allow for more scientific validation.

SCHEDULE: Schedule was delayed, primarily from the complexity of refactoring the "tclean" module to optimize imaging parallelization and memory consumption, and improve supportability. The code is complete and in testing, with completion of testing and release scheduled in August. Improved testing by the CASA team has caught significantly more issues than in the past. While the fixes have delayed delivery, they should provide in a more robust release.

RISK & MITIGATION: Further slippage could impact the ALMA pipeline schedule, as this is the release upon which the Cycle 8 pipeline will be based. Pipeline already uses this codebase for their development, and bug fixes will be limited to blocker issues (if found) to contain potential schedule impact. The ALMA pipeline has been testing with a stable pre-release to reduce risk. If any issues are discovered, a point release can be made to include fixes.

CARTA Rele	ase		CODE.	Scope		
Labor Actuals	Labor Actuals Expected DMS funds this activity at a higher WBS level.			The scripting interface in CARTA will serve as		
Material Actuals	Expected		the backbone for interactive clean integration with CASA scheduled for 1.5 in Q3.			
Travel Actuals						
SCHEDULE:			RISK & MITIGATIC	N:		
Milestone	Schedule	Target	Risk	Mitigation		
<ol> <li>CARTA I.4 Release</li> <li>CARTA I.5 Release (interactive clean)</li> </ol>	Mar 30, 2020 Jun 30, 2020	Aug 31, 2020 Dec 31, 2020	<ol> <li>NRAO is understaffed on this effort due to hiring challenges</li> </ol>	<ol> <li>Start our international new hire remotely in home country</li> </ol>		

SCOPE: Work on the Cube Analysis and Rendering Tool for Astronomy (CARTA) visualization software will continue through the collaboration with ASIAA CASA Development Center (ACDC) and the South African Institute for Data Intensive Astronomy (IDIA) with the intention of improving the user interface and expanding capabilities. CARTA will continue to provide frequent releases in FY2020 as the team works to complete full functionality. In Q1, release 1.3 will provide image overlay in World Coordinate System (WCS) groups. 1.4 is scheduled for Q2 to include multi-panel view and image fitting capability as well as development of a scripting interface. This scripting interface will serve as the backbone for interactive clean integration with CASA scheduled for 1.5 in Q3.

CARTA yearly planning at the face to face last Fall revised the schedule, lengthening the release cycle by ~30% and expanding the functionality going in to each release.

SCHEDULE: While CARTA 1.4 has not been released by the collaborative partners (due do a desire to get feedback for future development across the partnership) the work described has mostly been completed. This version includes scripting capabilities to support interactive clean. However, the interactive clean capability is behind schedule due to the delay in getting a visa for a resource hired by NRAO in January. AUI/NRAO are actively working to get the individual set up to work from Chile. Delivery of CARTA 1.5 is anticipated in Q1FY2021.

RISK & MITIGATION: NRAO is understaffed on this effort due to hiring challenges. We are starting our international new hire remotely in their home country (Chile).

Data Manag CASA NGI	ESTON gement & S CDR	NE # 6 Software	e.5.28							
COST:	COST: SCOPE:									
Labor Actuals DMS funds this acti	Labor Actuals Expected DMS funds this activity at a higher WBS level.		Milestone cancelled.							
Material Actuals \$	Material Actuals Expected  \$ \$		Review the CASA Next Generation Infrastructure project.							
Travel Actuals \$	Travel Actuals Expected \$ \$									
SCHEDULE:			RISK & MITIGATION:							
Milestone I. CASA NGI CDR	ScheduleTMay 30, 2020C	Target Cancel	Risk 1. Performance risk	Mitigation CNGI effort						
22		QSU3 F	Y2020	🛛 🐼 📣						

SCOPE: The CASA Next Generation Infrastructure (CNGI) study is currently underway to evaluate modern processing frameworks for suitability as a casacore replacement. In Q1 and Q2 the CASA team will be prototyping a selected framework by developing casacore functionality, new MS and Image file formats, and scalable parallel processing. This prototype will be presented and reviewed in Q3 as part of a Critical Design Review of the CASA Next Generation Infrastructure project. The results of the CDR will determine the future adoption and implementation plan of production CASA.

SCHEDULE The scope of the review was expanded to go beyond to casacore prototype to a larger review of ngCASA in general, and also made to be a CoDR, given the early stage of the project. The project team continued to work towards the prototype and review, but was not able to close the gap in new scope. The new set of actions is 1) to complete the prototype (Q2FY2020 POP goal), 2) evaluate a C++ upgrade option to CASA (Q3FY2020), and 3) develop and overall ngCASA delivery plan including requirements from ngVLA (TBD).

RISK & MITIGATION: The current implementation of CASA continues to be supported and developed. The CNGI effort intends to manage the performance risk of increasing data volume and supportability risk of an aging software base.

DMS	STO	NE # 6	5.33	Cost Schedule	
COST:	ement		SCOPE:		
Labor Actuals Expected DMS funds this activity at a higher WBS level.			The new archive is tar	rgeted to become the	
Material Actuals Expected S S		default in FY2020 with inclusion of VLBA, legacy VLA, and existing GBT data by Q3.			
Travel Actuals	Expected \$				
SCHEDULE:			RISK & MITIGATION:		
Milestone	Schedule	Target	Risk	Mitigation	
<ol> <li>Upgrade AAT/PPI software to 3.8.2</li> <li>Update infrastructure</li> <li>Complete telescope scope</li> </ol>	June 30, 2020 June 30, 2020 June 30, 2020	Complete Sep 28, 2020 TBD	<ol> <li>Schedule depends on many groups</li> </ol>	I. Management coordination	
		QSU3 F	Y2020	S 📚 🗚	

SCOPE: The new archive is targeted to become the default in FY2020 with inclusion of VLBA, legacy VLA, and existing GBT data by Q3.

SCHEDULE: Schedule was delayed by group focus on software delivery for Epoch 2.1 VLASS operations, which also required more resources than planned. The schedule has been broken into three deliverables.

RISK & MITIGATION: The schedule depends on resources from both inside and outside the group. Management will work across groups, departments, and observatories to keep deliverables coordinated.

	ESTO	NF # /	5 3 7	Cost	
Data Manag	gement 8	Softwar	e	Schedule	
OPT Release	e			Scope	
COST:			SCOPE:		
Labor Actuals Expected					
DMS funds this activity at a higher WBS level. Material Actuals Expected		The OPT will b	be updated in Q3 to support		
		Semester 2020BVLA observing.			
\$	\$				
Travel Actuals Expected					
\$	\$ \$				
SCHEDULE:			RISK & MITIGATION:		
Milestone	Schedule	Target	Risk	Mitigation	
I. OPT update	Jun 30, 2020	Aug 12, 2020	I. None		
		05112	¥2020	<b>1</b>	
		Q303 F	12020		

SCOPE: The OPT will be updated in Q3 to support Semester 2020B VLA observing.

SCHEDULE: Development responsibilities for the OPT were transitioned to the New Mexico Systems group earlier this year. After a review of priorities it was determined that the needs for 2020B could be met with an August delivery date, and that the change would allow the group to also make progress on some long-standing development requests. OPT Version 1.27.00 is scheduled for delivery on August 12<sup>th</sup>.

RISK & MITIGATION: No risk, updates will be included as required and in time for observing.

POP MIL	ESTO	NE # 7	.5.10		Cost
Program M	anageme	nt Depar	tment		Schedule
Project Man	agement	Software I	Decision		Scope
COST: No impa	ct to cost.		SCOPE:		
Labor Actuals	Labor Actuals Expected \$ \$			SCODE	
\$				scope	
Material Actuals	Expected				
\$	\$				
Travel Actuals	Expected				
\$	\$				
SCHEDULE:			RISK & MITIGATION:		
Milestone	Schedule	Target	Risk	Mitigation	
1. Software Decision	12/31/2019	FY2021	I. No risk.		
		05113 6	¥2020		
010		Q303 P	LOLO		

COST: No impact.

SCOPE: No impact.

SCHEDULE: We continue to evaluate the Oracle Prime Cloud software as it continues to develop. A decision will be made in FY 2021 in conjunction with a decision on a future ERP.

RISK & MITIGATION: No impact.

POP MIL Program Ma Project Mana COST: No impa Labor Actuals \$ Material Actuals \$ Travel Actuals \$ SCHEDULE: Milestone 1. Software Implementation	ESTO anagement S agement S agement S s Expected \$ Expected \$ Expected \$ Schedule 6/30/2020	NE # 7 nt Depar Software I	<b>7.5.11</b> tment mplementation SCOPE: No change in sco No change in sco RISK & MITIG/ Risk 1. No risk.	on ope ATION: Mitigation	Cost Schedule Scope
6		QSU3 F	72020		🖉 🎯 👪

COST: No impact.

SCOPE: No impact.

SCHEDULE: We continue to evaluate the Oracle Prime Cloud software as it continues to develop. A decision will be made in FY 2021 in conjunction with a decision on a future ERP.

RISK & MITIGATION: No impact.

	ESTO	NE #	7.5.12	Cost	
Program M	anageme	nt Depa	rtment	Schedule	
Multicancha	Construc	mplete	Scope		
COST: No know	vn impact to	cost.	SCOPE:		
Labor Actuals Expected			No change in scope		
\$ \$			i to change in scope		
Material Actuals	Expected				
\$	\$				
Travel Actuals	Expected				
\$	\$				
SCHEDULE:			RISK & MITIGATION:		
Milestone	Schedule	Target	Risk	Mitigation	
I. Multicancha Construction Complete	12/31/2019	FY2021	I. COVID 19 restrictions	I. Monitor	
		QSU3	FY2020	🛛 🐼 🖊	

COST: No known change to cost

SCOPE: No impact.

SCHEDULE: New construction completion date was being developed before COVID 19 outbreak. All work suspended until after COVID 19 restrictions are lifted.

RISK & MITIGATION: COVID 19 Restrictions continue. Monitor.

P	Program Mar Program Mar Multicancha JA COST: No known Labor Actuals	STO nageme O Acce impact to Expected \$	NE # 7 nt Depart eptance Co cost.	A.5.13 Cost Schedule Scope SCOPE: No change in scope			
	SCHEDULE:	\$ Expected \$		RISK & MITIGATION:			
	Milestone I. Multicancha JAO Acceptance Complete	Schedule 3/30/2020	Target FY2021	Risk I. COVID 19 Restrictions	Mitigation I. Continue to m	onitor	
28	QSU3 FY2020						

COST: No known change to cost.

SCOPE: No impact.

SCHEDULE: New construction completion date was being developed before COVID 19 outbreak. All work suspended until after COVID 19 restrictions are lifted.

RISK & MITIGATION: COVID 19 Restrictions, continue. Monitor.

Б		CTO	NIE # 7			Cast
ſ	Program Mar	nageme	nt Depart	.J.IJ tment		Schedule
	COST: No impact		scope			
	Labor Actuals	Expected		N		
	\$	\$		No change in scope		
	Material Actuals	Expected				
	\$	\$				
	Travel Actuals	Expected				
	\$	\$				
	SCHEDULE:			RISK & MITIGATION:		
	Milestone	Schedule	Target	Risk	Mitigation	
	I. VLBA Fiber Installation Complete	3/31/2020	9/30/2020	I. COVID 19 Restrictions	I. Monitor	
				(2020		2] ×** ALAI
29			QSU3 F1	2020		

COST: No change in cost.

SCOPE: No change in scope.

SCHEDULE: Three year no cost extension granted. Hancock NH will complete install by end of September 2020. Los Alamos is on hold until after COVID 19 restrictions.

RISK & MITIGATION: Los Alamos will continue to delay due to COVID 19. Uncertainty in operations returning to normal. Monitor

Program N	<b>DP MILESTONE # 7.5.16</b> rogram Management Department						
COST: No imp	pact to cost.	ort	SCOPE:		scope		
Labor Actuals \$	Labor Actuals Expected \$ \$		No change in scope	No change in scope			
Material Actuals \$	Expected \$						
Travel Actuals \$	Expected \$						
SCHEDULE:			RISK & MITIGATION:				
Milestone	Schedule	Target	Risk	Mitigation			
I. VLBA Fiber Final Report	3/31/2020	9/30/2020	1. COVID 19 Restrictions	I. Monitor			
30		QSU3	FY2020		2 @ AU		

COST: No change in cost.

SCOPE: No change in scope.

SCHEDULE: Three year no cost extension granted. Hancock NH will complete install by end of September 2020. Los Alamos is on hold until after COVID 19 restrictions.

RISK & MITIGATION: Los Alamos will continue to delay due to COVID 19. Uncertainty in operations returning to normal. Monitor

P	POP MILE Program Mai Band I LNA F	<b>STO</b> nageme Producti	<b>NE # 7</b> nt Depart on Comple	.5.19 tment ete		Cost Schedule Scope	
	COST:			SCOPE:			
	Actuals \$1,525,623 <sup>*</sup> *Current as of 7/9/	Expected \$1,512,202 20.		No change			
	SCHEDULE:			RISK & MITIGATION:			
	Milestone	Schedule	Target	Risk	Mitigation		
	I. Production Completion	6/24/2020	7/31/2020	<ol> <li>Not able to meet production deadline</li> <li>3 techs having project on BLD w/ no work</li> </ol>	<ol> <li>Submit CR for extend to end</li> <li>Find additional cover costs</li> </ol>	NCE to of July. funds to	
31	QSU3 FY2020						

COST: No production work occurred during IDOS status (there were 4 LNAs remaining to deliver to ASIAA). There was a budget impact of \$4,300 per month since 3 technicians have this project in their BLD and are unable to work (IDN status).

SCOPE: No impact.

SCHEDULE: ASIAA accepted NCE to allow production through July 2020. Production was completed on 7/23/20. Shipment to ASIAA is still in process.

RISK & MITIGATION: A NCE CR was approved on 5/19/20 to extend production to 7/31/20. Cost overrun noted. Working with CDL Director on funds to use to cover cost.
COST: Labor Actuals \$ Material Actuals \$ Travel Actuals \$	Expected S Expected S Expected S Expected S	Briefing	SCOPE: Milestone car Quarterly de scheduled win director's tra being cancelle cancelled.	ncelled. skside briefings were to be th key reporters based on the vel schedule. This milestone is ed since all travel has has been	
Milestone I. Deskside Briefing	Schedule 6/30/2020	Target Cancelled	RISK & MIT Risk I. N/A	Mitigation	
22		OSU3 E	Y2020	1 August	

SCOPE: Quarterly deskside briefings were to be scheduled with key reporters based on the director's travel schedule. This milestone is being cancelled since all travel has has been cancelled.

SCHEDULE: No impact.

F	<b>POP MILI</b> Education an Hosted Video	ESTO nd Public Assignn	<b>NE # 8</b> c Outread	5 <b>.5.11</b>	Cost Schedule Scope		
	COST:			SCOPE:			
	Labor Actuals	Expected		No scope cha	nge		
1	\$	\$		No scope cha	180		
	Material Actuals	Expected					
	\$	\$					
	Travel Actuals	Expected					
	\$\$						
	SCHEDULE:			RISK & MITIGATION:			
	Milestone	Schedule	Target	Risk	Mitigation		
	I. Complete Hosted Video	6/30/2020	8/4/2020	I. NA			
33			QSU3 F	r2020	🛛 🐲 AU		

SCOPE: No impact.

SCHEDULE: The production was delayed by our office shutdown. We experimented with home video, but ultimately set up a studio in a conference room. Complete.

Ρ	OP MILE Human Resc Bullying Preve COST: Labor Actuals \$ Material Actuals \$ Travel Actuals \$	Expected \$ Expected \$ Expected \$ Expected \$	NE # I	I.7.5 SCOPE: No change.		Cost Schedule Scope	2
	SCHEDULE:		RISK & MITIGATIO	DN:		_	
	Milestone	Schedule	Target	Risk	Mitigation		
	I. Deliver Bullying Prevention Training	6/30/2020`	Qtr.4	None			
34			QSU3 F1	/2020	b		

SCOPE: No impact.

SCHEDULE: Expected Training Completion Date Qtr. 4 (Launch Date August 3, 2020). Schedule slip due to change of vendor.

Ρ	OP MILE Human Reso	<b>STO</b>	NE # I	1.7.10		Cost Schedul	e
	Electronic Op COST: Labor Actuals \$ Material Actuals \$ Travel Actuals	Expected S Expected S Expected	ollment – N	Ion Open Enroll SCOPE: No change	lment	Scope	
ļ	\$ SCHEDULE: Milestone	\$ Schedule	Target	RISK & MITIGATIO Risk	N: Mitigation		
	<ol> <li>Establish online portal for new hires to complete benefits enrollments through employee self service</li> </ol>	6/30/2020	Qtr.4	I. None	Online portal		
35			QSU3 FY	/2020		2	<b>AU)</b>

SCOPE: No impact.

SCHEDULE: Expected Completion Date Qtr. 4

RISK & MITIGATION: No impact. MIS and HR have been working closely to establish an online portal for new hires to complete benefit enrollments electronically through Employee Self Services (ESS). Desired layouts have been determined and set up is currently underway for testing.

Ρ	<b>OP MILE</b> Human Reso Third Party B	STOI ources Benefits	<b>NE # I</b> Vendor U	<b>I.7.II</b> Jpload Prepara	tion		
	COST:			SCOPE:			
	Labor Actuals	Expected \$		Milestone cancelled.			
	Material Actuals	Expected					
	\$	\$					
	Travel Actuals Expected \$ \$						
	SCHEDULE:			RISK & MITIGATION:			
	Milestone	Schedule	Target	Risk	Mitigation		
	<ol> <li>Partner with MIS to deliver uploads of benefit information to various third party vendors.</li> </ol>	Q3 FY2020	Cancel	I. None			
36			QSU3 FY	2020		<b>V</b>	AUI

SCOPE: No impact.

SCHEDULE: The vendor file feeds goal has been reviewed, researched, and determined not feasible given our JDE interface compatibility and the HIPAA requirements Anthem and Delta require for transmitting sensitive health care information. The file specs provided by the vendors were reviewed in detail and compared to programs available through our internal JDE HRIS system and MIS operating programs. While this goal was established to help ease administration and manual data entry, JDE and MIS do not have the necessary programs or resources available to implement this goal at this time.

Р		STO	NE # I	1.7.15		Cost
-	Human Res					Schedule
	Delivery - Hi	iring Man	ager Traini	ng		Scope
	COST:			SCOPE:		
	Labor Actuals	Expected		No change		
	\$	\$				
	Material Actuals	Expected				
	\$	\$				
	Travel Actuals	Expected				
	\$	\$				
	SCHEDULE:			RISK & MITIGATION:		
	Milestone	Schedule	Target	Risk	Mitigation	
	I. Deliver Updated Hiring Manager Training	6/30/2020`	Qtr.4	I. None	Online training	
37			QSU3 F1	72020		2 😔 🔊

SCOPE: No impact.

SCHEDULE: Expected Completion Date Qtr. 4

RISK & MITIGATION: No impact. HR has developed an updated training module for hiring managers that include the new system enhancements. Training will be held virtually in Qtr. 4

F	POP MILI SciCom	ESTO	NE # I	2.2.3				
	COST: Labor Actuals \$ Material Actuals \$	Expected S Expected S Expected S		SCOPE: Milestone cancelled				
	Travel Actuals  \$ SCHEDULE: Milestone	Expected \$ Schedule	Target	RISK & MITIGATIC Risk	N: Mitigation			
	I. Proposal deadline	4/14/2020 	None	I. None				
38			QSU3 FY	/2020		No.	<b>\$</b> \$	AU1

SCOPE: No impact.

SCHEDULE: The science symposium proposal deadline for the AAAS 2021 Annual Meeting was originally 14 Apr 2020. Shortly after the COVID-19 pandemic began, on 9 April, the AAAS extended this proposal deadline to 14 July 2020 (Q4) and soon converted the 2021 Annual Meeting to a wholly virtual conference. The AAAS substantially altered the required format and content for science symposia and substantially reduced their value to the NRAO. After substantial discussion, the NRAO decided to not submit a AAAS science symposium for the 2021 AAAS Annual Meeting. Therefore, the milestone is being cancelled.

COST:			SCOPE:			
Labor Actuals     Expected       \$     \$       Material Actuals     Expected       \$     \$       Travel Actuals     Expected       \$     \$		Milestone cancelled. The effort was based physical security imp features. Scope inclu a physical security pl Observatory securit	Milestone cancelled. The effort was based on the review of physical security implementation and features. Scope includes the development of a physical security plan to enhance the Observatory security.			
SCHEDULE:	1		RISK & MITIGATIO	RISK & MITIGATION:		
Milestone	Schedule	Target	Risk	Mitigation		
<ol> <li>Develop Security Plan</li> </ol>	Q2, FY2020	TBD	I. MIssed plan date for implementation	<ol> <li>Cancelled for FY2020, defer until COVID response requirements stabilize</li> <li>Will be moved to 2021 POP goals.</li> </ol>		

COST: No change

SCOPE: Cancelled.

SCHEDULE: Defer to FY2021.

RISK & MITIGATION: Missed implementation, defer to FY2021.

COST:	·		SCOPE:	
Labor ActualsExpected\$\$Material ActualsExpected\$\$Travel ActualsExpected\$\$		Milestone cancelled. The costing development required the successful completion of the physical security plan development (Milestone 13.6.5). The security plan development eliminated the ability to complete this contingent milestone.		
SCHEDULE:			<b>RISK &amp; MITIGATIO</b>	DN:
Milestone	Schedule	Target	Risk	Mitigation
I. Cost Security Recommendations	Q3, FY2020	TBD	<ol> <li>Missed plan date for implementation</li> </ol>	<ol> <li>Cancelled for FY20, defer until COVID response requirements stabilize</li> <li>Will be moved to 2021 POI goals.</li> </ol>

COST: No change.

SCOPE: Cancelled.

SCHEDULE: Defer to FY2021.

RISK & MITIGATION: Missed plan, defer to FY2021.

F	POP MIL	ESTO	NE # I	3.6.9	Cost	
	Administrat	tion - MIX	) a through		Scope	
	COST:	n-boardii	ig unrough	SCOPE:		
	Labor Actuals  Material Actuals  Travel Actuals	Expected \$ Expected \$ Expected		In coordination with HR, implement Employee Benefits On-Boarding workflow through JDE Employee Self-Service.		
	\$  \$		RISK & MITIGATION:			
	Milestone I. Implement	Milestone         Schedule         Ta           I. Implement         Q2 FY2020         Q4		Risk 1. None or low risk impact	Mitigation 1. Continue to utilize current	
				to HR or Employees	process flow for employee on- boarding	
41			QSU3 FY	/2020	2 @ AU1	

COST: Costs are internal except for minimal questions to consultant (ad hoc, consulting contract for HR related questions).

SCOPE: Implementation of On-Boarding workflow in JDE.

SCHEDULE: Q2 scheduled date was impacted by other projects (Monthly exempt staff transitioning to bi-weekly payroll). New schedule target is implementation in Q4 to setup new fiscal year. This is due to impact of staffing on other projects (COVID-19 related, Bank account transition, HR vendor uploads, others).

RISK & MITIGATION: Risk is none to low impact for this project. This is a tool that would assist HR in new employee sign-ups for benefits. Mitigation is to continue to utilize current process flows in employees enrollment in benefits.

COST:			SCOPE:			
Labor Actuals	Expected		Milestone cancelled	Milestone cancelled		
\$	\$		No change in scope. Tentatively rescheduled			
Material Actuals	Expected					
\$	\$		for FY2021 due to COVID-19.			
Travel Actuals	tuals Expected \$					
\$						
SCHEDULE:			RISK & MITIGATION:			
Milestone	Schedule	Target	Risk	Mitigation		
1. C2G 2020 Commence Workshop	Q3 FY 2020	Q3 FY2021	1. Spread of COVID-19	<ol> <li>Delay meeting one year</li> </ol>		

COST: No change in cost at this time. Budget unspent.

SCOPE: No change in scope at this time.

SCHEDULE: Milestone cancelled in FY2020 and tentatively moved meeting to FY2021.

RISK & MITIGATION: All face-to-face meetings cancelled in FY2020 Q3 and Q4 to minimize/slow spread of COVID-19. Though meeting is tentatively scheduled for Q3 FY2021, the situation will need to be reassessed in Q1 and Q2 of FY2021 to see if a face-to-face meeting is even possible in Q3 of FY2021.

F		ЕЯТО	NE # I	4.1.11		Cost		
	Budget					Schedule		
	Evaluate ID	E dosit	ion contr	ol module				
	COST:			SCOPE:				
	Labor Actuals	Expected		Work w/HR & MIS to	sition			
	\$	\$		control module for potential implementation of NRAO position control activities currently				
	Material Actuals	Expected						
	\$	\$		done on spreadsheets.				
	Travel Actuals Expected \$ \$							
	SCHEDULE:			RISK & MITIGATION:				
	Milestone	Schedule	Target	Risk	Mitigation			
	I. Review JDE module	6/30/2020	9/30/2020	<ol> <li>Unable to schedule review w/Brij &amp; key staff</li> </ol>	<ol> <li>Be prepared for expedite Brij or acceptance.</li> </ol>	or further delay; iontract		
43			QSU3 F1	/2020	K	2i 📀 AU1		

SCOPE: Scope is intact.

SCHEDULE: Schedule delayed due to other priorities within MIS; especially accommodating IDOS transitions

RISK & MITIGATION: Risk is to timing only. Current process is functional; this would provide for automation and maintaining information in the system as opposed to manually.

COST:			SCOPE:					
Labor Actuals	Expected							
\$	\$		Milestone car	ncelled. Next meeting in				
Material Actuals	Expected		FY2021 POP.					
\$	\$							
Travel Actuals	Travel Actuals Expected							
\$	\$							
SCHEDULE:			RISK & MITIC	RISK & MITIGATION:				
Milestone	Schedule	Target	Risk	Mitigation				
I. Meeting	Q3 FY2020	FY2021	I. None					
	,			T				

SCOPE: No impact.

SCHEDULE: Meeting was cancelled due to COVID-19 and no international travel. Milestone is cancelled.

RISK & MITIGATION: None.

F	<b>POP MIL</b> Director's C	ESTO Office	NE # I	6.2.5		
	COST: Labor Actuals Expected \$ \$ Material Actuals Expected \$ \$ Travel Actuals Expected		SCOPE: Milestone cancelled			
	\$ SCHEDULE: Milestone I. Meeting	\$ Schedule Q3	Target QI FY2021	RISK & MITIGATIO Risk I. None	N: Mitigation	
45			QSU3 FY	72020		aui

SCOPE: No impact.

SCHEDULE: The Visiting Committee meeting schedule has been moved back to every other year. In the meantime, a GBOVC has been initiated on a two year face-to-face cycle, starting with a telecon taking place in Fall 2020 (September 28-30, 2020). Therefore, the milestone is being cancelled.



FY20	019			QI FY	020 Perfo	rmance	Q2 FY2	020 Perfo	mance	Q3 FY	2020 Perform	mance
POP	Milestone	Completion	New Completion	Cost	Sched	Scope	Cost	Sched	Scope	Cost	Schedule	Scope
2.5	NA ALMA Operations		1									
	Maintenance, Renewal, and Warranty Claims											
29	Deliver reworked FEHV I to JAO	12/31/2018	11/1/2019									
30	Deliver FEHVs 2, 2, and 4 to JAO	9/30/2019	11/1/2019	2			j.	1				
	NRAO-Chile Office											
34	Insuguration of Multiconche	9/30/2019	6/1/2020	Cancel	led, in FY20	20 POP	Cancel	led, in FY20	20 POP	Cance	led, in FY202	OPOP
3.3	New Mexico Operations											
	Very Large Array											
	Development						2				( )	
14	VLASS1.1 Single epoch continuum imaging complete	12/31/2018	11/1/2019		Cancelled			Cancelled			Cancelled	
	Technical Upgrades and Enhancements											
41	Install ACUs in three antennas, #11, 12, and 13	9/30/2019	12/31/2019									
42	Install upgraded servo SCR cards in three antennas	9/30/2019	12/31/2019				-				1	
	Very Long Baseline Array			1			÷	6	1		14 - N	
	Maintenance and Renewal	1						-				
60	Major VLBA Maintenance Visit #1	6/30/2019	7/24/2020									
4.6	Next Generation Very Large Array		2									
	Conceptual Design and Development	-			1							
20	System Requirements and Architecture Review	9/30/2019	6/30/2020									
22	Antenna Optical Design	3/30/2019	9/30/2020	1								
29	Wide Band Feed Designs	9/30/2019	11/1/2019			1						
31	Integrated Receiver Development Tests	9/30/2019	6/30/2020									
5.3	Central Development Laboratory											
	Research and Development											
12	Test SADC prototype ASIC	6/30/2019	3/31/2020							Comple	eted See four	square.
6.7	Science Support and Research											
	Science Ready Data Products											
17	Pilot SRDP Operations Complete	9/30/2019	12/1/2019									
7.5	Data Management and Software											
	CASA											
21	CASA 6.0 release	6/30/2019	12/1/2019				2					

POP Milestone				QI FY2	020 Perfo	mance	Q2 FY2	020 Perfo	mance	Q3 FY	2020 Perform	nance
	Milestone	Completion	New	Cost	Sched	Scope	Cost	Sched	Scope	Cost	Schedule	Scope
0.3	Program Management Department			1								
	Headquarters											
6	Program Management Software Solution Implementation	6/30/2019	6/1/2020	Cancel	led, in FY20	20 POP	Cancel	led, in FY20	20 POP	Cance	lled, in FY202	POP (
7	Multicancha Mass Concrete Works Complete	12/31/2018	2/1/2020	Cancel	led, in FY20	20 POP	Cancel	led, in FY20	20 POP	Cance	lled, in FY202	POP
8	Multicancha Beams Erection Complete	12/31/2018	2/1/2020	Cancel	led, in FY20	20 POP	Cancel	led, in FY20	20 POP	Cance	lled, in FY202	POP (
9	Multicancha Membrane Installation Complete	3/30/2019	2/1/2020	Cancel	led, in FY20	20 POP	Cancel	led, in FY20	20 POP	Cance	lled, in FY202	POP (
10	Multicancha Sport Flooring Installation Complete	3/30/2019	2/1/2020	Cancel	led, in FY20	20 POP	Cancel	led, in FY20	20 POP	Cance	lled, in FY202	POP
11	Multicancha Construction Complete	9/30/2019	2/1/2020	Cancel	led, in FY20	20 POP	Cancel	ed, in FY20	20 POP	Cance	lled, in FY202	POP
13	SRDP Wave I Review	9/30/2019	11/1/2019	8 8	1 2						4 4	
	New Mexico Operations			12 2	1	1					1	
20	VLBA Fiber Final Service Analysis Report	9/30/2019	3/1/2020	Cancel	led, in FY20	20 POP	Cancel	led, in FY20	20 POP	Cance	lled, in FY202	POP
	Central Development Lab			1. 18	1						13 3	
28 FY2(	018				Q1 FY202	,		Q2 FY202	•	Q3 FY	2020 Perform	nance
28 FY2(	DI8 POP Milestone	Milestone	New Completion	Cost	QI FY202 Sched	Scope	Cost	Q2 FY202 Sched	Scope	Q3 FY Cost	2020 Perform	nance Scope
POP Section	D18 POP Milestone	Milestone	New Completion Date	Cost	QI FY202 Sched	Scope	Cost	Q2 FY202 Sched	Scope	Q3 FY Cost	2020 Perforr Schedule	Scope
POP Section 43	POP Milestone Central Development Laboratory	Milestone	New Completion Date	Cost	QI FY202 Sched	Scope	Cost	Q2 FY202 Sched	Scope	Q3 FY Cost	2020 Perform	Scope
POP Section 4.3	POP Milestone Central Development Laboratory Research and Development	Milestone	New Completion Date	Cost	QI FY202 Sched	Scope	Cost	Q2 FY202 Sched	Scope	Q3 FY Cost	2020 Perform	Scope
POP Section 4.3 8	POP Milestone Central Development Laboratory Records and Development Explore DONT caloration	Milestone 9/30/2018	New Completion Date	Cost	QI FY202 Sched	Scope	Cost	Q2 FY202 Sched	Scope	Q3 FY Cost	2020 Perforr	Scope
28 FY2( POP Section 43 8	POP Milestone Central Development Laboratory Research and Development Explore DOTT Laboratory rgVLA Consume Dotted Development Consume Dotted Development Consume Deve	Milestone 9/30/2018	New Completion Date 12/13/2019	Cost	QI FY202 Sched	Scope	Cost	Q2 FY202 Sched	Scope	Q3 FY Cost	2020 Perfor	Scope
28 FY2( POP Section 4.3 8 4	POP Milestone Central Development Laboratory Research and Development Explore DOTT calibration using hotcold none regitLa Conceptual Design & Development Homelium Grancehourd	Milestone 9/30/2018	New Completion Date 12/13/2019	Cost	QI FY202 Sched	Scope	Cost	Q2 FY202 Sched	Scope	Q3 FY	2020 Perfor	Scope
28 FY2( POP Section 4.3 8 4 12	POP Milestone Central Development Laborstory Resort and Development Explore DCHT caleration using hotcold none regital Conceptual Design 6 Development Algorithmic Study released Bit Minesine code netword	Milestone 9/30/2018 9/30/2018 9/30/2018	New Completion Date 12/13/2019 6/30/2020	Cost	QI FY202 Sched	Scope	Cost	Q2 FY202 Sched	Scope	Q3 FY	2020 Perforr	Scope
28 FY2( POP Section 4.3 8 4 12 15 3.11	POP Milestone Central Development Laboratory Research and Development Explore DOTT Laboratory ReyLA Conceptual Design & Development Agorthmic Story released Bit Migarison study released Bit Migarison Subservatory	Milestone 9/30/2018 9/30/2018 9/30/2018	New Completion Date 12/13/2019 6/30/2020 12/13/2019	Cost	QI FY202 Sched	Scope	Cost	Q2 FY202 Sched	Scope	Q3 FY	2020 Perforr	Scope
28 FY2( POP Section 4.3 8 4 12 15 3.11	POP Milestone Central Development Laboratory Resorts and Development Epitors DONT calibration using hote old-none ngVLa Conceptual Design & Development Algorithmic Study released BIS Magnitos caluty released BIS Magnitos actively released Dag Baseline Observatory Domerational destribution	Milescone 9/30/2018 9/30/2018 9/30/2018	New Completion Date 12/13/2019 6/30/2020 12/13/2019	Cost	QI FY202 Sched	Scope	Cost	Q2 FY202 Sched	o Scope	Q3 FY Cost	2020 Perform	Scope
POP Section 43 8	POP Milestone Central Development Laboratory Research and Development Explore DOPT calibration using hot-cold-none regVLA	Milestone 9/30/2018	New Completion Date	Cost	QI FY202 Sched	Scope	Cost	Q2 FY202 Sched	Scope	Q3 FY Cost	2020 Perforr	Sc
28 FY2( POP Section 43 8 4 12 15 3.11	POP Milestone Central Development Laboratory Research and Development Explore DOFT calaration using hot: old-none reg/LA Conceptual Design 6 Development Algorithms: Study released BIT Regations endy released Lang Baseline Observatory	Milestone 9/30/2018 9/30/2018 9/30/2018	New Completion Date 12/13/2019 6/30/2020 12/13/2019	Cost	QI FY202 Sched	Scope	Cost	Q2 FY202 Sched	Scope	Q3 FY Cost	2020 Perform	Scope
28 FY2( POP Section 43 8 4 12 15 3.11	POP Milestone Central Development Laboratory Research and Development Explore DOTT Laboratory ReyLA Conceptual Design & Development Agorthmic Study released BIR Magistion study released Ling Bateline Observatory Operational Activities	Milestone 9/30/2018 9/30/2018 9/30/2018	New Completion Date 12/13/2019 6/30/2020 12/13/2019	Cost	QI FY202 Sched	Scope	Cost	Q2 FY202 Sched	Scope	Q3 FY Cost	2020 Perform	Scope

COST:			SCOPE:				
Labor Actuals Expected							
There are no changes in budget.			Major maintenance site for multiple prev activities that requir is no change to the s	Major maintenance visit to Los Alamos VLBA site for multiple preventive maintenance activities that require additional staff. There is no change to the scope.			
Milestone	Schedule	Target	Risk	Mitigation			
I Completion of maintenance visit	6/30/2019	9/30/2020	Azimuth 2 wheel assembly failure	Routine monitoring of assembly performance and lubrication quality. Send separate team for assembly swap if needed.			

COST: No change.

SCOPE: No change. Visit includes a preventive replacement of the azimuth 2 wheel assembly.

SCHEDULE: Originally delayed to Q2 FY2020 due to the FY2019 St. Croix repair project. Staff and equipment have since been unable to travel due to COVID-19 travel restrictions. Pending obtaining permission from the Los Alamos National Laboratory for the full team to access the antenna, and finding suitable accommodation for the team in the area, the major maintenance visit to Los Alamos is now expected to occur in Q4 FY2020.

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. Currently there are no signs this will be needed, despite this being the oldest remaining wheel assembly in the VLBA.

COST:							
Labor Actuals	Expected		An external system-level requirements and				
\$	\$		architecture review v	architecture review will be conducted by the			
Material Actuals	Expected		end of Q4 FY19. The review will ensure an appropriate level of completeness in the				
\$	\$		requirements, and architectural coherence,				
Travel Actuals	Expected		prior to completing sub-system conceptual				
\$	\$		design down-selections. Completed.				
SCHEDULE:			RISK & MITIGATION:				
Milestone	Schedule	Target	Risk	Mitigation			
Requirements & Architecture Review	9/30/2019	6/30/2020	Incomplete definition of subsystem requirements	Complete the review			

### NOTES ARE REQUIRED FOR EACH 4-SQUARE REPORT

COST: no change

SCOPE: no change

SCHEDULE: A Stakeholders Requirements Review was held in Socorro on September 26, 2019, partially fulfilling the original intent of this milestone. 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 were addressed, and the review was successfully concluded. The high-level architecture was viewed as sufficiently mature for this stage of the project; a more in-depth review of the system architecture needs to occur in the future, perhaps as part of the system CoDR. The Requirements Verification and Traceability Matrix (RVTM) and System Requirements documents have since been updated. The documents for a remote System Requirements Review (SRR) were distributed to the review committee in late May/early June. The resulting RIDs were discussed and addressed. The SRR was completed on June 12, 2020.

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. If the review is not completed, 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.

F	Y2019 P	OP M	ILEST	Cost				
	Antenna Opt	ical Desi	gn		Scope			
	COST:			SCOPE:				
	Labor Actuals	Expected   Expected   Expected  Expected  Expected  Expected  Expected		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 <sub>sys</sub> with Gaussian feed borns				
	\$							
	Material Actuals							
	\$							
	Travel Actuals							
	\$	\$		Gaussian leeu norns.				
	SCHEDULE:			RISK & MITIGATION:				
	Milestone	Schedule	Target	Risk	Mitigation			
	Revised optical design	3/30/2019	9/30/2020	Less than optimal aperture efficiency and/or a late optical design introduces major structural changes to the antenna.	Ensure the optical design is optimized prior to the completion of a detailed mechanical design of the antenna			
51			QSU3 F1	72020	2 S AU			

COST: no change

#### SCOPE: no change

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 new optical design needs to be completed before Q1 FY2021, when we expect to release an RfP for the preliminary design of a prototype antenna. The design work has been contracted to EMSS, who are currently scheduled to deliver the optical design in Q4 FY2020. (Target date remains the same as reported in the QSU for Q2 FY2020).

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. 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.

FY2019 PO	OP M	ILEST	FONE # 4.6.	Cost
Integrated Re	ceiver D	evelopm)	scope:	Scope
Labor Actuals \$ Material Actuals \$ Travel Actuals \$	Labor ActualsExpected\$\$Material ActualsExpected\$\$Travel ActualsExpected\$\$		The Integrated Recei downconversion, sam transmission in a light that offers advantages reliability. The perform Receiver chip will be demonstration board	ver concept combines opling, and data t weight, compact package s in cost, performance, and mance of the Integrated characterized with a
SCHEDULE:	1		<b>RISK &amp; MITIGATIC</b>	N:
Milestone	Schedule	Target	Risk	Mitigation
Complete tests of the Integrated Receiver chip on a demonstration board.	9/30/19	9/30/20	ASIC does not perform as designed	<ol> <li>Revise the design to correct shortcomings revealed in the characterization tests.</li> <li>Adopt the discrete component design, which will require more space and cooling.</li> </ol>
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### NOTES ARE REQUIRED FOR EACH 4-SQUARE REPORT

COST: No change

SCOPE: No change. The Integrated Receiver concept was demonstrated with discrete components, but 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.

SCHEDULE: The ASIC chips were delivered to NRAO, and a demonstration board for testing the chips was fabricated. Initial tests revealed numerous manufacturing errors on the part of the vendor (City Semiconductor). Steps were taken to address the errors, but additional tests were delayed when NRAO entered its Infectious Disease Operations Status (IDOS) as a result of COVID-19. Testing of the modified ASIC has since resumed. The current goal is to thoroughly test and analyze the ASIC by Q4 FY2020. At that time, the status of the ASIC will be re-evaluated to determine next steps in its development. Note: this task tracks CDL milestone 5.3.12.

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.

COST:		/ 1010	SCOPE:	Photo of a populated SADC			
Labor ActualsExpected\$\$Material ActualsExpected\$\$Travel ActualsExpected				Approximately 50% to 75% of			
				and signal access connectors.			
			Initial testing revealed several errors in the chip implement: (vendor issue).Work-around for the critical issues identified				
			chips hardware "edited." Digital output stage of the serializer only of marginally sufficient amplitude as probed on the board Suspect parasitics associated with pins getting into the FPGA				
\$	\$		closing the eye completely. Request that this milestone be closed.				
SCHEDULI	E:		RISK & MITIC	GATION:			
Milestone	Schedule	Target	Risk	Mitigation			
I Test SADC prototype ASIC	Was 6/30/2019 Revised to 9/30/2019 in FY2019Q3, then to 12/31/2019 in FY19Q4, then to 3/21/2020 in FY20Q1, and finally to 6/26/2020 in FY20Q2.	Not Applicable. I Not applicable. Request that this milestone be closed.		Not much progress or positive results expected at this point. Although the SAD( concept remains valid, this is being counted as a failed wafer run. Discussions ongoing with ngVLA management about trying again with a different vendor.			

COST: Not Applicable.

SCOPE: The initial delivered chips had several errors that were the fault of the contractor (City Semiconductor in San Francisco, CA). The most damaging issue was traced back to a missing connection from the power supply to the output stage of the circuit. A number of the chips have undergone a crude fix known as a "FIB edit", where a focused ion beam is used to cut some traces and add others, bypassing faulty circuitry and repairing the problem. Five chips have thus been edited. Carefully planned and performed the mounting of one of those edited chips onto our evaluation board and resumed testing under IDOS. At this point we have tried everything we could think of to make the SADC work but have failed at our attempts. The digital output stage of the serializer is only providing marginally sufficient amplitude as probed on the board, and we suspect that the last few parasitics associated with pins getting into the FPGA is closing the eye completely. We're checking a few final tests (like trying a second FIB-edited chip to see if it is any different), but do not expect to see anything different at this point. Discussions are ongoing with ngVLA management about trying again with another vendor.

SCHEDULE: Not Applicable.

**RISK & MITIGATION: Not Applicable.** 

F	Y2019 P	OP M	ILEST	ONE # 6.7	Cost			
	Science Sup	port and	Researc	h (SRDP)	Schedule			
	SRDP Pilot	Operatio	ons Com	plete	Scope			
	COST:			SCOPE:				
	Labor Actuals	Expected		No change to overall project scope, this is a				
	\$	\$ no change		carryover from FY19				
	Material Actuals	Expected		As a result of responding to external scope				
	\$ \$ no change			adjustments during Pilot Development, ALMA				
	Travel Actuals	Expected		delayed, priorities an	d resource constraints in			
	\$	\$ no change		DMS introduced further delays.				
	SCHEDULE:			RISK & MITIGATION:				
	Milestone	Schedule	Target	Risk	Mitigation			
	I End of Pilot Ops	I End of Pilot Ops Sep 30, 2019		ISchedule Risk	Accept (see notes)			
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### NOTES ARE REQUIRED FOR EACH 4-SQUARE REPORT

#### COST: No Change

SCOPE: No Change to overall project scope, priorities were adjusted to exchange some scope items between Pilot development and Wave I development, primarily to support large projects. These scope adjustments resulted in deferred deployment of the ALMA User Driven Imaging (AUDI) until near the planned end of Pilot Operations. The final capability, ALMA User Driven Imaging (AUDI), was deployed but insufficient operational experience was gained by the scheduled target of Q4 FY2019. Pilot AUDI operations are currently ongoing. The suspension of ALMA observations has provided an opportunity for users to explore the AUDI capability, increasing community engagement and expanding the base of operational experience.

SCHEDULE: The original target for completion of Pilot Operations was Q4 FY2019, most of which has been met with the exception of AUDI. We are extending the Pilot Operations period to allow for development of operational experience.

RISK & MITIGATION: Risk of further schedule delay is low, preliminary results from validation indicate most known issues have been adequately addressed.

F	Y2018	POP	MILES	<b>TONE # 4.1</b>	2 Cost			
-	ngVI A				Schedule			
	Algorithm	nic Stud	y		Scope			
	COST:			SCOPE:				
	Labor Actuals	Expected		Conduct an analysis of the ngVLA imaging				
	\$	\$ Expected \$ Expected		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 ngVI & reference observing program. Internal				
	Material Actuals							
	\$							
	Travel Actuals							
	\$	\$		review in progress.				
	SCHEDULE:			RISK & MITIGATION:				
	Milestone	Schedule	Target	Risk	Mitigation			
	I Algorithm study released (report/memo)	rithm study ed t/memo)		Under-estimation of the computational resources required by the project.	<ol> <li>Maintain focus of key staff involved on this activity.</li> <li>Characterize the estimation uncertainty in the ngVLA reference design and define adequate contingency budget for DS2020.</li> </ol>			
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SCOPE: No impact.

SCHEDULE: Competing priorities within NRAO (e.g. algorithms for VLASS) have delayed the completion of this milestone. It also required input from the ngVLA reference observing program, which has been completed. A draft memorandum documenting the algorithm study has been written, and is scheduled for release in Q4 FY2020. Contending with COVID over the last quarter has also delayed the memo release.

RISK & MITIGATION: The risk of not completing the algorithmic study is under-estimating the computational resources that will be required by ngVLA to produce its expected science products. In addition, a weak estimate 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 in writing the report. It would also be adequate to conduct a review of this report in anticipation of requests for additional information from DS2020.



#### Updated 07/22/2020

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:**

- I. 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.



## **COVID Expense Review**

- NRAO established Infectious Disease Operating Status (IDOS) policy. Activated 3/16/20. Applies to all AUI radio astronomy fund sources. IDOS ended 6/5/20 after 12 weeks. Entered RTFO (Return to Full Operations) Phase 1 on 6/6/20.
- Wages (IDOS) record worked from home; worked from site; unable to work. (Phase I) record worked from home, regular work, unscheduled.
  - In IDOS, N/E work at site generates 50% premium.
  - Only potential savings from delays to seasonal labor (mostly GBO).
- Non-salary
  - Infectious Disease Response specific costs (travel cancellations, PPE, special supplies or accommodations) being tracked.

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# IDOS Summary Statistics: 3/13-6/5

	IDOS TO	OTALS
Pay Code	Hours	Cost
Site Worked	26,277	1,753,646
Non-Worked	67,770	2,958,922
Remote/WFH	137,319	10,401,393
TOTALS	231,365	15,113,961
Туре	Hours	%
Worked	163,596	64%
Non-Worked	67,770	26%
Leave	17,599	7%
Other	7,238	3%
Total	256,202	100%

During 12 week IDOS period, 26% of all hours were non-worked for a cost of just under \$3M or 19.6% of direct payroll costs. (Note: statistics include GBO.)

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## Non-salary COVID Costs through 6/30/2020

	CSA-A	CSA-V	CSA-L	CSA-N	ICC	Total
Communications	816					816
Computer Hardware	1,277	450	165			1,892
Conf/Seminar Registration	17	1,389			1,639	3,045
Domestic Travel	760	32,200	899	706	3,494	38,059
Foreign Travel	21,146	4,621			1,262	27,029
Supplies	1,549	598	200		40,555	42,903
Travel Relocation		13,299				13,299
Grand Total	25,566	52,557	1,264	706	46,950	127,043

- Continuing to ID and book costs of cancelled travel.
- Includes WFH access costs: monitors, chairs, cables, etc.
- Paying individual mileage to VLA site for former bus-riders.

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## Q3 FY2020 Notes

- NRAO has created management reporting to exclude the impact of benefits variance from individual units. As in past practice, that amount is now summarized as fund source adjustments for each fund source and included in the Director's Office WBS.
- New fringe approach in place, includes employee welfare benefits + PTO. Budget @ 61.75% Q3 Actual @ 57.0% (\$1.4M overrecovery, rerate requested – approved in July.) Difference attributable to decrease in benefits (health care costs) and lower than expected non-vacation leave utilization.
- General underspends, Q3 reflects cessation of travel and IDOS.
- ICC underrecovered \$.9M. Reflects general underspends. Rerate requested – approved in July.

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	FY 20			YTD %
	POP	FY 20 Rev.	FY20 YTD	Rev
NSF	34,970	34,970	34,970	100.0%
Carryforward/Other	0	8,082	8,082	0.0%
Total Revenues	34,970	43,052	43,052	100.0%
Telescope Ops	10,841	12,010	7,349	61.2%
Development	3,606	2,894	1,771	61.2%
Science Ops	7,400	9,238	5.096	55.2%
Admin Services	9,863	11,763	6,375	54.2%
Director's Office	2,469	2,472	1,612	65.2%
Ed. & Public Outreach	791	820	556	67.8%
ngVLA	0	3,855	2,373	61.6%
FY20, Total	34,970	43,052	25,131	58.4%
FY20 CSA-V Net	0	0	17,921	

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# CSA-A Q3 Results

	FY 20			YTD %
	POP	FY20 Rev.	FY20 YTD	Rev
	Budget	Budget		Budget
NSF	47,260	47,260	47,260	100.0%
Carryforward	6,158	8,107	8,107	100.0%
Canadian Contribution	1,787	0	0	0.0%
Other	844	790	593	100.0%
Total Revenues	56,049	56,157	55,960	99.6%
Telescope Ops	28,310	22,675	12,683	55.9%
Development	3,181	10,149	462	4.5%
Science Ops	7,158	7,241	4,640	64.1%
Admin Services	8,744	10,930	6,171	56.5%
Director's Office	3,446	3,589	2,097	58.4%
Education & Public Outreach	761	783	516	65.9%
FY 20, Total	51,600	55,367	26,568	48.0%
FY20 CSA-A Net	4.449	791	29.392	6

• Director's Office includes fund source adjustments.

- Telescope Ops budget reduction reflects reclass of reserves budget to Development.
- Telescope Ops low due to favorable exchange rates and ALMA shutdown.

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		FY 20			YTD %			
		POP	FY 20 Rev.	FY20 YTD	Rev			
	NSF	3.430	3.760	4.288	114.0%			
	Telescope Time Sales	4,614	5,009	4,891	97.6%			
	Carryforward	71	128	128				
	Other	333	624	621	99.5%			
	Total CSA-L Revenues	8,448	9,521	9,927	104.3%			
	Telescope Ops	5,311	6,417	3,572	55.7%			
	Development							
	Science Ops							
	Admin Services	2,673	2,584	1,782	69.0%			
	Director's Office	464	464	360	77.6%			
	Education & Public Outreach							
	FY 20	8,448	9,465	5,714	60.4%			
	FY20 CSA-L Net	0	56	4,213				
	Science Ops Admin Services Director's Office Education & Public Outreach FY 20 FY 20 CSA-L Net	2,673 464 8,448 0	2,584 464 <b>9,465</b> 56	1,782 360 5,714 4,213	69.0% 77.6% <b>60.4</b> %			
FY20 CSA-L Net		0	56	4,213				


		FY20 POP	FY 20 Rev.	FY20 YTD	YTD % Rev	
		Budget	Budget	Expenses	Budget	
	NRAO Recoveries	17,271	17,222	10,111	58.7%	
	External Recoveries	1,445	1,445	1,154	79.8%	
	Total ICC Revenues	18,716	18,667	11,264	60.3%	
	Telescope Ops	109	112	118	105.4%	
	Development	484	492	328	66.6%	
	Science Ops	2,841	2,870	1,917	66.8%	
	Admin Services	13,158	13,032	8,430	64.7%	
	Director's Office	2,124	2,161	1,399	64.7%	
	FY20, Total	18,716	18,667	12,192	65.3%	
	FY20 ICC Net	0	0	-927		
<ul><li>Reduc</li><li>Under</li></ul>	tion in ICC budg -recovery related	et reflec I to rate	cts staffi e approv	ing cha val dela	nges. iys.	





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This quarter had varying degrees of impact on the four divisions of EPO. I have nothing to report from the visitor center. We have been shut down since March 15 and don't have an opening date set. For now, I just a have a big thank you to safety for graciously dealing with all the persistent visitors who ignored our closed "until further notice" signs and insist on driving onto the site.

Since the educators were not busy with tours, they found an online alternative to the in person NAI certification that they had wanted to participate in. Both are now certified interpretive guides.



In May and June, the STEAM Ed team's partnership with the African-American Teaching Fellows (AATF) as part of the STEAM Education Think Tank culminated in the creation of five lesson plans for teaching astronomy-based content for K-12 classes, with different lessons for elementary, middle, and high school students, created by teachers, for teachers. These lesson plans are compiled onto a website created by the Think Tank for teachers around the country to access and bring the joys of astronomy into the classroom for their students: <a href="https://steamedthinktank.wixsite.com/lessons">https://steamedthinktank.wixsite.com/lessons</a>



The News and Multimedia divisions managed to navigate the transition to work from home and then partially back into the office with just a little disruption. The news division put out one announcement, four feature stories, and eight press releases that were supported visually by the multimedia group. Here we have once announcement about our Grote Reber Fellow receiving an Einstein fellowship and two of the four feature stories. The first is our quarterly Baseline video that we are distributing as a Feature Story. The other Feature was about our Jansky Fellows.



The other two Feature Stories were about the CDL and the extraordinary efforts that the VLA went to in order to keep staff safe while keeping observations and even a reconfiguration of the array going.



We had three press releases that featured VLA results: one on the mathematical gymnastics to calculate the wind speed on a brown dwarf, another a new class of cosmic explosion that resembles a GRB and a supernova, but not quite like either one of those. The third one features the VLA's ability to look through dust to confirm a suspected protostar in a binary system. ALMA revealed the one protostar and VLA confirmed that it was indeed a binary.



These next two press featured featured international collaborations. First the Megamaser Cosmology Project used the VLBA, VLA, and GBT along with the Effelsberg telescope in Germany resulted in some distance measurements that challenge the standard model of the universe.

ALMA, which is part of the EHT, contributed to an observation at the heart of Quasar 3C 279, revealing the sharpest detail of its jet to date.



We had three additional ALMA results: one revealed the composition of an interstellar comet, one that revealed a massive disk galaxy much earlier in the universe than we thought could exist, and one result that combined results from the VLA to reveal the huge extent of the atmosphere of Antares. My planetarium friends were excited by this one since it's actually something they can point out in the night sky.



The Antares result was also an opportunity for the MMG to experiment a bit with Augmented reality. They built a 3D model of the star. Its atmosphere and orbits of planets in our solar system are included for scale.

They also worked with a model of the North American ALMA dish to replace the European dish on our website. I've included the QR codes if you'd like to check them out on your mobile device.



These are a few screen shots of the VR plotting of astronomical data in Unity3D that one of our artists has been working on. The meat of the work was done in the coding to create the particle system. What looks like a globular cluster is actually a view from outside the data set of about 100,000 stars. The smaller screen shot is from the center of that data set, and she looked towards the stars of our winter sky, so you see Orion there. This is her summary of the work done:

My goal was to find a way to import astronomical data into Unity for use in VR. I started with creating a virtual sky/star field from actual data by using the Unity Particle system. Particles can be rendered en masse and are ideal for large data sets. The first round of data that I used was the HYG database since it was the easiest to work with. I used the magnitude (brightness) of the star and the Cartesian coordinates from the data (X,Y,Z). I wrote a script to apply the data to the particle system so that it created the 'stars' with their correct coordinates and magnitudes.

Image 1 – the ball of stars, Image1b – from inside VR



Second I tried to come up with a way to convert RA and Dec in unity to cartesian components. This was successful but does not have the z depth. So I limited the data to the brightest stars and made it into a night sky like you would see in a planetarium with labels on some of the stars.

Image 2 – shows the sphere of stars with some labels, Image 3– shows the stars from inside VR without labels.

I am currently working on the data from the BESSEL survey but the data takes a bit more math and interpretation to show up correctly in Unity3D.





The big pivot for social media that I mentioned last quarter was to work the bugs out of Facebook Live events. In April, May, and June we had two events each month.



We had two Facebook live events in June that featured interviews with a VLA and VLBA operator. Nan Janney is behind the scenes and Dave Finley was the interviewer.



Social Media is also making a special effort to provide virtual access to the VLA through stunning photography by our staff. This is daybreak captured by one of our safety officers. We also featured the webcam and the VLA explorer. All of these were popular posts on Facebook. So we are carrying on successfully.

