



<b>Title:</b> QSU4 FY2020	<b>Author:</b> Thisdell/ADs	<b>Date:</b> 11/5/2020
		<b>Version:</b> Final

## National Radio Astronomy Observatory

### Quarterly Status Update (QSU) 4 FY2020

July - September 2020

<b>PREPARED BY</b>	<b>ORGANIZATION</b>	<b>DATE</b>
Thisdell/ADs	Director's Office	11/5/2020

<b>APPROVALS (Name and Signature)</b>	<b>ORGANIZATION</b>
Nicole Thisdell	NRAO
Tony Beasley	NRAO
Dave Curren	AUI

NRAO Quarterly Status Update  
July - September 2020  
QSU4 FY2020

POP Milestone	Milestone	Completion Date	Q1 Performance Assessment			Q2 Performance Assessment			Q3 Performance Assessment			Q4 Performance Assessment			Color code: Cost/Schedule/Scope Cells		
			Cost	Schedule	Scope	Cost	Schedule	Scope	Cost	Schedule	Scope	Cost	Schedule	Scope			
2.5	NA ALMA Operations																
	Operations																
1	Investigate logistics and feasibility for interferometric workshops	3/30/2020															
		12/31/2019															
		3/30/2020															
		6/30/2020															
2	Review conference applications	3/30/2020															
		6/30/2020															
3	Special ALMA Session at AAS Winter 2020 meeting	3/30/2020															
4	Participate and Sponsor ISMS	6/30/2020															
5	Participate and Execute SIS	6/30/2020															
6	Coordinate planning and execution for Cycle 8 APR	6/30/2020															
	Development																
7	FY2021 (Cycle B) Call for Study Proposals	3/30/2020															
8	FY2021 (Cycle B) Study Award Notifications	9/30/2020															
	Site Office																
9	Power options for Parque Astronómico Atacama and ALMA	12/31/2019															
		3/30/2020															
		6/30/2020															
		9/30/2020															
10	Office lease alternatives for OCA	12/31/2019															
11	IT involvement in STEM education and diversity programs	6/30/2020															
12	OCA Disposition of fiscal documents	9/30/2020															
13	Plan to improve maintainability of AOS technical building	12/31/2019															
		3/30/2020															
14	Management of FHV warranty	12/31/2019															
		3/30/2020															
15	Multicenter project – delivery and inauguration	12/31/2019															
		3/30/2020															
		6/30/2020															
		9/30/2020															
16	Collective bargaining	12/31/2019															
		3/30/2020															
		6/30/2020															
		9/30/2020															
17	STEM EPO and DM	12/31/2019															
		3/30/2020															
		6/30/2020															
		9/30/2020															
3.3	New Mexico Operations																
	Very Large Array																
	Operations																
1	Define VLA GO and SRO capabilities to be offered for Semester 2020B	12/31/2019															
2	Define VLA GO and SRO capabilities to be offered for Semester 2021A	6/30/2020															
3	Update VLA documentation to support 2020B Call for Proposals, perform proposal technical reviews	3/30/2020															
4	Update VLA documentation to support 2021A Call for Proposals, perform proposal technical reviews	9/30/2020															
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															
11	Cross-training operators on VLA and VLBA instruments completed	9/30/2020															
12	VLA technical manager assumes scheduler duties for major maintenance and overhauls for the VLA and the VLBA	6/30/2020															
	Development																
13	Realize operational with VLASS Epoch 2 observing	6/30/2020															
14	Realize project complete	9/30/2020															
15	VLBA operation expanded to more antennas	9/30/2020															
	Maintenance and Renewal																
16	VLBA power system replacement	6/30/2020															
17	Perform five antenna overhaul during the year	9/30/2020															
18	Replace one antenna azimuth bearing during the year	9/30/2020															
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															
22	Perform preventive maintenance on each of two transporters prior to array reconfiguration to A	9/30/2020															
23	Identify and replace 5000 amp or damaged cross-ties during the course of the year	9/30/2020															
24	Identify and replace five antenna intersections during the course of the year	9/30/2020															
25	Perform preventive maintenance on the next configuration VLA antenna transformers prior to array reconfiguration to D	12/31/2019															
26	Perform preventive maintenance on the next configuration VLA antenna transformers prior to array reconfiguration to C	3/30/2020															
27	Perform preventive maintenance on the next configuration VLA antenna transformers prior to array reconfiguration to B	6/30/2020															
28	Perform preventive maintenance on the next configuration VLA antenna transformers prior to array reconfiguration to A	9/30/2020															
29	Purchase RF test instrumentation (SCIDA)	9/30/2020															
30	Replace several old heavy vehicles	9/30/2020															
31	Purchase electrical arm switches	9/30/2020															
32	Purchase Control Building HVAC compressor	9/30/2020															
33	Improve site road lighting	9/30/2020															
34	Purchase ACU upgrade components	9/30/2020															
35	Purchase track maintenance materials	9/30/2020															
	Technical Upgrades and Enhancements																
36	Plan and polarize observations to SRO	3/30/2020															
37	YUPPI pulsar observations to GO	9/30/2020															
38	Plan smoothing system in correlation	9/30/2020															
39	Complete installation of 1 more ACUs	9/30/2020															
40	Integrate VPD cryogenic system for 10 testing	6/30/2020															
41	Install VPD compressor and refrigeration lines and tanks on antenna	9/30/2020															
42	Install several wind and rain conditioning system on all antennas	9/30/2020															
	Very Long Baseline Array																
	Operations																
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															
46	Update VLBA documentation to support 2021A Call for Proposals, perform proposal technical reviews	9/30/2020															
47	Implement VLBA user help program	3/30/2020															
48	Evaluate pySCHED	3/30/2020															
49	Plan for future RFI monitoring	9/30/2020															
50	VLBA/BA technical managers assume full administration of the JRA-based maintenance tracking system	3/30/2020															
	Development																
51	Deliver production proposal for Oryx rollout to all VLBA sites	3/30/2020															
52	Demonstrate Oryx capabilities in lab	9/30/2020															
53	Initial development of network performance diagnostic tool	3/30/2020															
54	E-transfer of VLB data from VLBA sites to SSCC corridor	6/30/2020															
	Maintenance and Renewal																
55	Major Maintenance Vex 01	6/30/2020															
56	Major Maintenance Vex 02	9/30/2020															
57	Cold temperature operating report	12/31/2019															
58	4 days observing performed from SRO to GO	3/30/2020															
59	11 antennas from SRO to SRO	3/30/2020															
60	Install upgraded VLBA weather station at one site	9/30/2020															
61	Complete installation of 8 racks at all VLBA sites	9/30/2020															
62	Finalize design of production E-Link power supply	3/30/2020															
4.3	Central Development Laboratory																
	Operations																
1	Build and test Band 1 cryogenic amplifiers	12/31/2019															
		3/30/2020															
		6/30/2020															
2	Build and test ALMA Band 1 local oscillators	12/31/2019															
		6/30/2020															
	Development																
3	Design Band 4x2 Nuanetsis SS mixer	9/30/2020															
4	Exhaustive upgraded balanced IF amplifiers	9/30/2020															
5	Design, fabrication, and testing of 10 MHz short baseline antenna	12/31/2019															
6	Design OMT with band gap structure	6/30/2020															
7	Implement polarization processing with VLBA Front End	6/30/2020															
8	Design SADC program for W-band Front End	9/30/2020															
9	Intense transmission-line reflectometer fiber development with																



POP Milestone		Q1 Performance Assessment			Q2 Performance Assessment			Q3 Performance Assessment			Q4 Performance Assessment			Color code: Cost/Schedule/Scope Cells			
Milestone		Completion Date	Cost	Schedule	Scope	Cost	Schedule	Scope	Cost	Schedule	Scope	Cost	Schedule	Scope			
28	CASA Not CDM	6/30/2020															
29	CASA Testing Roadmap	6/30/2020							Cancelled								
	CASA Pipeline																
30	Pipeline C/SDP Release	12/31/2019															
31	Pipeline CB Test Release	9/30/2020															
32	Pipeline Python 3 Planning	12/31/2019															
	Science Support and Archives																
33	Archive Assessment	6/30/2020															
34	PST Updated for Semester 2020B	12/31/2019															
35	PST Updated for Semester 2021A	6/30/2020															
36	QPT Updated for Semester 2020B	12/31/2019															
37	QPT Updated for Semester 2020B	6/30/2020															
38	PMT Updated for Semester 2020B TAC	3/30/2020															
39	PMT Updated for Semester 2021A TAC	9/30/2020															
40	ISDP Wave-1	12/31/2019															
41	ISDP Wave-2	9/30/2020															
42	TTA Tool C/DR Support	12/31/2019															
	Algorithm Research and Development																
43	Fully Heterogeneous Array Imaging	9/30/2020															
44	Commission Full Polarization Primary Beam Modeling Algorithm	9/30/2020															
45	Commission Wide Field Full-Field Image Algorithm	9/30/2020															
7.5	Program Management Department																
	PMD Operations																
1	HQ PMSE Project Leadership	12/31/2019 3/30/2020 6/30/2020 9/30/2020 12/31/2019															
2	NH PMSE Project Leadership	3/30/2020 6/30/2020 9/30/2020 12/31/2019															
3	CDL PMSE Project Leadership	3/30/2020 6/30/2020 9/30/2020 12/31/2019															
	Proposal Development																
4	HQ Proposal Development	12/31/2019 3/30/2020 6/30/2020 9/30/2020 12/31/2019															
5	NH Proposal Development	3/30/2020 6/30/2020 9/30/2020 12/31/2019															
6	CDL Proposal Development	3/30/2020 6/30/2020 9/30/2020 12/31/2019															
	PM Activities																
7	HQ Continuing Education	12/31/2019 6/30/2020 3/30/2020 9/30/2020 12/31/2019															
8	NH Continuing Education	9/30/2020 3/30/2020 6/30/2020 12/31/2019															
9	CDL Continuing Education	9/30/2020 3/30/2020 6/30/2020 12/31/2019															
	PMSE Activities																
10	Program Management Software Decision	12/31/2019															
11	Program Management Software Implementation	6/30/2020															
12	Multicarrier Construction Complete	12/31/2019															
13	Multicarrier JAD Acceptance Complete	3/30/2020															
14	ISDP TTA Tool Concept Design Review	12/31/2019															
15	VLBA Floor Installation Complete	12/31/2019															
16	VLBA Floor Final Report	3/30/2020															
17	VLBA St. Cross Repair Complete	6/30/2020															
18	VLBA St. Cross Repair Final Report	9/30/2020															
19	Band 1 LNA Production Complete	3/30/2020															
8.5	Education and Public Outreach																
	News and Public Information																
1	Identify potential image or story to feature	12/31/2019 3/30/2020 6/30/2020 9/30/2020 12/31/2019															
2	Reserve room with AAS	3/30/2020 6/30/2020 9/30/2020 12/31/2019															
3	Coordinate with AAS	3/30/2020 6/30/2020 9/30/2020 12/31/2019															
4	Define promotional materials for Astronomers	12/31/2019															
5	Establish calendar and contacts for desktop briefing	12/31/2019 3/30/2020 6/30/2020 9/30/2020 12/31/2019															
6	Contact reporter for briefing	6/30/2020 9/30/2020 12/31/2019							Cancelled			Cancelled					
	Multimedia Team																
7	Define menu of press product image options	12/31/2019															
8	Determine specifications for Gallery	12/31/2019															
9	Workframe of new image gallery interface	9/30/2020															
10	Identify topic for hosted video	12/31/2019 3/30/2020 6/30/2020 9/30/2020 12/31/2019															
11	Complete assignments for hosted video	3/30/2020 6/30/2020 9/30/2020 12/31/2019															
12	Define format and develop procedure for populating style guide	3/30/2020 6/30/2020 9/30/2020 12/31/2019															
13	Present and Review populated style guide to EPO team	9/30/2020															
14	Create A&A data application and web plugin	6/30/2020															
15	STFAM LE																
16	San Pedro Cohort operation	12/31/2019															
17	NH Cohort operation	3/30/2020															
18	Identify new centers for outreach booth	6/30/2020															
19	Identify National Association for Astronomy workshops for certified trainers	3/30/2020															
19	VLBA 40th Anniversary planning	9/30/2020															
	VLA VC Operations																
20	Survey alternative options	12/31/2019															
9.4	Computing and Information Services																
	Observatory-Wide Support																
1	Upgrade of the platform to Pigeon	12/31/2019															
2	Allocate office connectivity	3/30/2020															
3	Cyber Security risk assessments	12/31/2019															
4	Security Controls and Log Management	6/30/2020															
5	Cyber Security training	9/30/2020															
6	Information Privacy Policy release	12/31/2019															
7	Non-employee account audit	3/30/2020															
8	Application Whitelisting	6/30/2020															
9	Evaluation of MS Office 365 applications	9/30/2020															
	Site Specific Facilities Infrastructure																
10	VLA CME and network upgrade	3/30/2020															
11	Local area network upgrade at the NAAC	6/30/2020															
	Maintenance and Renewal																
12	Video System end-of-life migration	9/30/2020															
10.2	Office of Diversity and Inclusion																
	Local and National Programs																
1	Diversity Council quarterly meetings	12/31/2019 3/30/2020 6/30/2020 9/30/2020 12/31/2019															
2	NAC and LEAMP Recruitment	3/30/2020 6/30/2020 9/30/2020 12/31/2019															
3	Summer programs initiated and completed	9/30/2020															
4	NAC Annual Meeting completed	9/30/2020															
5	RADIAL Project Plan and Proposal completed	3/30/2020															
6	Diversity and Cultural Awareness training offered	12/31/2019 3/30/2020 6/30/2020 9/30/2020 12/31/2019															
	International Partnerships																
7	Chile REL program recruitment completed	12/31/2019															
8	Chile REL program completion	3/30/2020															
9	NINE recruitment and completion	9/30/2020															
11.7	Human Resources																
	Workforce Management																
1	qVLA Hiring	12/31/2019 3/30/2020 6/30/2020 9/30/2020 12/31/2019															
2	GRO Five Year Proposal Workforce Management Plan	3/30/2020 6/30/2020 9/30/2020 12/31/2019															
	Training and Development																
3	Observatory Leadership Cohort Pilot Assessment/Implementation plan	12/31/2019															
4	How to Train in Observatory Employees Training Module	3/30/2020															
5	Building Prevention - Online Training	6/30/2020															
	Compensation																
6	Review Online Marketing Pricing Tool	12/31/2019															
7	Finalize Variable Pay Plan	12/31/2019															
8	JDE Position Control Module Implementation Preparation	9/30/2020															
9	Career Pathing	9/30/2020															
	Benefits																
10	Electronic enrollment - Non open enrollment benefit entry	12/31/2019 3/30/2020 6/30/2020 9/30/2020 12/31/2019															
11	Third Party Benefits Vendor Upload Preparation	3/30/2020 6/30/2020 9/30/2020 12/31/2019							Cancelled								
12	Work with Aon to research Retiree Medical Plan for Chilean 15%	3/30/2020															
	Recruitment/Employee																
13	Jobvac Enhancements	3/30/2020															
14	Hiring Manager Training Design	3/30/2020															
15	Hiring Manager Training Delivery	6/30/2020															
16	Background and Credit Check for Specific Positions	3/30/2020															
	HR																
17	FY2019 Climate Survey Results Initiatives	12/31/2019															

POP	Milestone	Completion Date	Q1 Performance Assessment			Q2 Performance Assessment			Q3 Performance Assessment			Q4 Performance Assessment			Color code: Cost/Schedule/Scope Cells		
			Cost	Schedule	Scope	Cost	Schedule	Scope	Cost	Schedule	Scope	Cost	Schedule	Scope			
14	PTO budget structure in POP Chart	9/30/2020															
15.3	Spectrum Management																
1	WRC-19 Share E-Shed	12/31/2019															
2	NIP DS Games	6/30/2020							Cancelled								
3	Other ITU-R Working Parties	6/30/2020															
4	URS GASS, Rome	9/30/2020															
16.2	Director's Office																
	ALMA																
1	ALMA Board Meeting	12/31/2019															
		6/30/2020															
2	ALMA Director's Council	9/30/2020															
		9/30/2020															
	Corporate Meetings																
		12/31/2019															
3	AUI Board of Trustees Meeting	3/30/2020						Cancelled									
		6/30/2020															
		12/31/2019															
4	AUI Executive Committee Meeting	3/30/2020															
		6/30/2020															
		9/30/2020															
5	AUI Visitor 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 Review																
8	NHF Annual Program Review	12/31/2019															
		12/30/2020															
9	All-Hands Meeting	9/30/2020															

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**Color code: Cost/Schedule/Scope Cells**

**Blue** - early

**Green** - on track

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

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

**Grey** - completed

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# Milestone Progress

Milestone Progress	Annual POP Score Card	Previous Years
Total Q4 FY2020 milestone deadlines: 103	Total number of 2020 POP Milestones: 301 milestones with 375 quarterly deadlines	Total number of 2019 POP Milestones: 364
Total completed on time: 79		Percent completed on time: 81.7%
Percent completed on time: 76.7%		Percent completed in the year: 89.5%
9 cancelled - 33 carryovers	Total 2020 quarterly deadlines completed on time: 288	Percent postponed to next year: 6.2%
5 carryover milestones - 3 completed - 1 cancelled	Percent completed on time: 76.8%	Percent cancelled: 5.3%
Total Q3 FY2020 milestone deadlines: 88	Total completed in FY2020: 319	Total number of 2018 POP Milestones: 352
Total completed on time: 60	Percent completed in the year: 85%	Percent completed on time: 81.7%
Percent completed on time: 68%		Percent completed in the year: 89.5%
12 cancelled - 3 early	Total moved to next year: 33	Percent postponed to next year: 5.1%
7 carryover milestones - 2 completed	Percent postponed to next year: 8.8%	Percent cancelled: 2%
	FY2019 milestones outstanding: 0	
Total Q2 FY2020 milestone deadlines: 101	FY2018 milestones outstanding: 1	Total number of 2017 POP Milestones: 303
Total completed on time: 79		Percent completed on time: 82.84%
Percent completed on time: 78%	Total 2020 milestones cancelled: 23	Percent completed in the year: 89.11%
2 cancelled - 1 early	Percent of 2020 milestones cancelled: 6.1%	Percent postponed to next year: 5.94%
11 carryover milestones - 3 completed		Percent cancelled: 4.62%
Total Q1 2020 milestone deadlines: 82		Total number of 2016 POP Milestones: 311
Total completed on time: 70		Percent completed on time: 85.21%
Percent completed on time: 85%		Percent completed in the year: 91.32%
0 cancelled - 2 early		Percent postponed to next year: 3.86%
18 carryover milestones - 7 completed		Percent cancelled: 4.82%



POP MILESTONE # 2.5.14

NRAO-Chile Office

Management of warranty for FEHV

Cost

Schedule

Scope

COST:

Labor Actuals	Expected
\$	\$
Material Actuals	Expected
\$	\$
Travel Actuals	Expected
\$	\$

SCOPE:

The Front End Handling Vehicles (4) were delivered to the OSF and conditionally 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.

SCHEDULE:

Milestone	Schedule	Target
1. Mgt of warranty issues	Q2 FY2020	Q3-Q4 FY2021

RISK & MITIGATION:

Risk	Mitigation
1. JAO is unable to close action items	Accept risk, cannot mitigate

3

QSU4 FY2020

**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 October 2020, the JAO moved to the extended caretaker team phase of its return to operations. The OSF ramp up and first stages of AOS operations are scheduled to take place in subsequent months. Assuming no setbacks, pending actions for the FEHV could be closed during Q3 or Q4.

#### RISKS & MITIGATION:

The JAO is currently focused on the return to operations and may not be able to devote resources and effort to close pending action items. This risk cannot be mitigated unless action items are reassigned. Deterioration of idle vehicles due to lack of use has been mitigated by running them monthly.

POP MILESTONE # 2.5.15				Cost
NRAO Chile Office				Schedule
Multicancha Project – Delivery and Inauguration				Scope
<b>COST:</b>		<b>SCOPE:</b>		
Labor Actuals	Expected	Construction and delivery of an indoor sports facility for ALMA observatory staff use at the OSF. Contractor was demobilized in late March due to COVID-19. Negotiations are underway to suspend the contract indefinitely with minimal or no monthly payments.		
\$	\$			
Material Actuals	Expected			
\$	\$			
Travel Actuals	Expected			
\$	\$			
<b>SCHEDULE:</b>		<b>RISK &amp; MITIGATION:</b>		
Milestone	Schedule	Target	Risk	Mitigation
1. Delivery/Inauguration	Q1-Q3	N/A	1. Schedule slippage: Uncertainty about restart 2. Deterioration of materials 3. Contractor goes out of business during suspension	1. Pandemic and JAO RTO beyond our control; accept risk 2. Proper storage 3. Accept risk

**COST:** The cost of suspending the contract between March 21<sup>st</sup> and September 30<sup>th</sup> was USD 562K (CLP 460M), considering contractor staff salaries, equipment, and rentals that were kept in stand by mode. Given the risks posed by the pandemic, the uncertain date for a restart of construction within the JAO return to operations (RTO) planning, the standing army costs, as well as the desire to minimize risks for the JAO RTO, it was decided to negotiate an indefinite suspension of the contract with minimal or no monthly payments.

**SCOPE:** The scope of the project remains the same as originally planned with an earned value of 75% to date.

**SCHEDULE:** The indefinite suspension establishes a three-month notice before resuming work, to allow the contractor to rehire workers. Once the work resumes, and if no major setbacks occur, the construction is estimated to last eight months, plus two additional months for punch list and delivery to the JAO.

#### RISKS & MITIGATION:

**1- COSTS OF INDEFINITE SUSPENSION:** It is estimated that a one year suspension will cost ~USD 98K in payments to the contractor for long-term removal of remaining equipment and machinery on site, perishables, insurance, and marginal severance and vacation costs.

**Deterioration** of critical materials due to long-term exposure on site, most notably the wooden beams and membranes, could add cost if replacements or repairs are necessary. Another risk is that the contractor goes out of business during the suspension, forcing NRAO/AUI to rebid the remaining construction at a substantially higher cost than the balance of the current turnkey contract.

**MITIGATION:** Proper storage of critical materials will mitigate, but not eliminate, risk of deterioration (e.g. long-term folding of membrane may damage it).

**2- SCHEDULE -** This risk is twofold: a) Ability to resume work depends on the evolution of the pandemic and the schedule and success of the JAO RTO. b) Deterioration of materials may require major repairs or ordering of long lead-time items, such as the wooden beams and membranes.

**MITIGATION:** a) Pandemic and JAO RTO are outside our control; no mitigation is possible. b) Periodic inspections to the site will identify problems in a timely manner so that such contingencies can be considered in the planning.

RETIRED RISK: - Schedule risk due to COVID-19 has been eliminated since the resumption of works will occur at a time when the pandemic is under control and/or JAO operations have stabilized.

# POP MILESTONE # 3.3.12

NM Operations

VLA technical manager assumes scheduler duties for major maintenance and overhauls for the VLA and the VLBA

Cost




Schedule

Scope

<b>COST:</b> <table> <tr> <th>Labor Actuals</th> <th>Expected</th> </tr> <tr> <td colspan="2">There are no changes in budget.</td> </tr> </table>			Labor Actuals	Expected	There are no changes in budget.		<b>SCOPE:</b> <p>The VLA Technical Manager will take over scheduler duties for major maintenance and overhauls for the VLA and VLBA from the Array Operations Division Head during Q3.</p>								
Labor Actuals	Expected														
There are no changes in budget.															
<b>SCHEDULE:</b> <table> <tr> <th>Milestone</th> <th>Schedule</th> <th>Target</th> </tr> <tr> <td>I. Scheduling of major maintenance</td> <td>6/30/2020</td> <td>3/31/2021</td> </tr> </table>			Milestone	Schedule	Target	I. Scheduling of major maintenance	6/30/2020	3/31/2021	<b>RISK &amp; MITIGATION:</b> <table> <tr> <th>Risk</th> <th>Mitigation</th> </tr> <tr> <td>I. None</td> <td>I. No mitigation needed.</td> </tr> </table>			Risk	Mitigation	I. None	I. No mitigation needed.
Milestone	Schedule	Target													
I. Scheduling of major maintenance	6/30/2020	3/31/2021													
Risk	Mitigation														
I. None	I. No mitigation needed.														

5

QSUA FY2020

COST: No impact.

SCOPE: No impact.

SCHEDULE: Training on the scheduler duties for the VLA Technical Manager was further delayed by the inefficiencies associated with the ongoing COVID pandemic. The training on scheduler duties, which includes developing familiarity with Microsoft Project, is now expected to take until Q2 FY2021.

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

# POP MILESTONE # 3.3.14

## NM Operations

### Realfast project complete

Cost




Schedule

Scope

<b>COST:</b> <table> <tr> <th>Labor Actuals</th> <th>Expected</th> </tr> <tr> <td colspan="2">There are no changes in budget.</td> </tr> </table>		Labor Actuals	Expected	There are no changes in budget.		<b>SCOPE:</b> <p>The original scope of this milestone was to have the Realfast project completed by Q4, and ready for final scientific commissioning by NRAO.</p>							
Labor Actuals	Expected												
There are no changes in budget.													
<b>SCHEDULE:</b> <table> <tr> <th>Milestone</th> <th>Schedule</th> <th>Target</th> </tr> <tr> <td>I. Complete Realfast Project</td> <td>9/30/2020</td> <td>9/30/2021</td> </tr> </table>		Milestone	Schedule	Target	I. Complete Realfast Project	9/30/2020	9/30/2021	<b>RISK &amp; MITIGATION:</b> <table> <tr> <th>Risk</th> <th>Mitigation</th> </tr> <tr> <td>I. None</td> <td>I. No mitigation needed</td> </tr> </table>		Risk	Mitigation	I. None	I. No mitigation needed
Milestone	Schedule	Target											
I. Complete Realfast Project	9/30/2020	9/30/2021											
Risk	Mitigation												
I. None	I. No mitigation needed												

6

QSU4 FY2020

**COST:** No impact. The Realfast project has been granted a no-cost extension by the NSF.

**SCOPE:** No impact.

**SCHEDULE:** There has been a delay in the handover of the full operations of Realfast to NRAO by the Project Team. Specifically, the Project Team still needs to write up the procedure for identifying candidate events, and train NRAO Data Analysts in quality assurance of those events. On NRAO's side, all default continuum observing setups for the lower frequency bands (L through X) need to be changed to use realfast, and candidate realfast events need to be ingested into the NRAO archive.

**RISK & MITIGATION:** There is no risk in delaying the completion of this milestone. The Realfast Project Team will continue to be responsible for the data processing, and the delivery of the results to the community, until NRAO takes over the Realfast operations.



## POP MILESTONE # 3.3.17

NM Operations

Perform five antenna overhauls during the year

Cost

Schedule

Scope

<b>COST:</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%; padding: 2px;">Labor Actuals</th> <th style="width: 50%; padding: 2px;">Expected</th> </tr> <tr> <td colspan="2" style="padding: 5px;">There are no changes in budget.</td> </tr> </table>			Labor Actuals	Expected	There are no changes in budget.		<b>SCOPE:</b> <p>In a normal year, five VLA antennas are overhauled during the year. With the COVID pandemic and the need to modify all work procedures to be COVID-safe, we only completed four overhauls. The scope of this milestone is changed to completing four overhauls.</p>								
Labor Actuals	Expected														
There are no changes in budget.															
<b>SCHEDULE:</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 33%; padding: 2px;">Milestone</th> <th style="width: 33%; padding: 2px;">Schedule</th> <th style="width: 33%; padding: 2px;">Target</th> </tr> <tr> <td style="padding: 5px;">I. Antenna overhauls</td> <td style="padding: 5px;">9/30/2020</td> <td style="padding: 5px;">9/30/2020</td> </tr> </table>			Milestone	Schedule	Target	I. Antenna overhauls	9/30/2020	9/30/2020	<b>RISK &amp; MITIGATION:</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%; padding: 2px;">Risk</th> <th style="width: 50%; padding: 2px;">Mitigation</th> </tr> <tr> <td style="padding: 5px;">I. Increased failure rate of VLA antenna hardware</td> <td style="padding: 5px;">I. Increased monitoring and re-prioritizing of overhaul schedule as needed</td> </tr> </table>			Risk	Mitigation	I. Increased failure rate of VLA antenna hardware	I. Increased monitoring and re-prioritizing of overhaul schedule as needed
Milestone	Schedule	Target													
I. Antenna overhauls	9/30/2020	9/30/2020													
Risk	Mitigation														
I. Increased failure rate of VLA antenna hardware	I. Increased monitoring and re-prioritizing of overhaul schedule as needed														

7
QSU4 FY2020

**COST:** No impact.

**SCOPE:** Normally five VLA antennas are overhauled every year. However, the need to re-design all the overhaul procedures to take into account new COVID-safe practices, and the reduced staffing available at the start of the outbreak, meant that only four overhauls were completed in FY2020. The antenna overhauls in FY2021 will be covered by a new milestone, so we propose to close out this FY2020 one with reduced scope (80% complete).

**SCHEDULE:** No impact.

**RISK & MITIGATION:** The risk of not completing the normal number of antenna overhauls in one year is that we fall behind in critical maintenance, and that antenna hardware may start to fail. The mitigation is to continue preventive maintenance in the field and decrease the inspection intervals so that we can reprioritize the order of the antenna overhaul schedule as needed.

## POP MILESTONE # 3.3.18

### NM Operations

Replace one antenna azimuth bearing during the year

<b>COST:</b>			<b>SCOPE:</b>	
Labor Actuals	Expected		In a normal year, one azimuth bearing is changed on a VLA antenna. The resources were not available in FY2020 due to the COVID pandemic. This milestone is therefore being cancelled.	
There are no changes in budget.				
<b>SCHEDULE:</b>			<b>RISK &amp; MITIGATION:</b>	
Milestone	Schedule	Target	Risk	Mitigation
I. Bearing change	9/30/2020	Cancelled	I. Increased failure rate of VLA antenna hardware	I. Increased monitoring and re-prioritizing of overhaul schedule as needed

**COST:** No impact.

**SCOPE:** Normally one azimuth bearing is changed on a VLA antenna each year. All engineering activities are taking longer during the COVID pandemic because of the need to use COVID-safe practices, so the resources needed to support the bearing change were not available. This milestone is being cancelled. A new milestone for an azimuth bearing change is included in the FY2021 POP.

**SCHEDULE:** No impact.

**RISK & MITIGATION:** The risk of not completing the azimuth bearing change this year is an increased risk of bearing failure in the field. The mitigation is to increase the monitoring of key bearing failure indicators such as the presence of metal particles in the grease. Grease samples will be regularly monitored for metallic particles that would indicate likely bearing failures.

## POP MILESTONE # 3.3.23

NM Operations

Identify and replace 5000 aging or damaged cross-ties during the course of the year

Cost

Schedule

Scope

<b>COST:</b> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <tr> <th style="width: 30%;">Labor Actuals</th> <th style="width: 70%;">Expected</th> </tr> <tr> <td colspan="2" style="padding: 5px;">There are no changes in budget.</td> </tr> </table>			Labor Actuals	Expected	There are no changes in budget.		<b>SCOPE:</b> <p style="margin: 5px 0;">In a normal year, 5000 cross-ties are replaced on the VLA railroad track. With the need to re-design all procedures to be COVID-safe, only 2344 were completed in FY2020. The scope of this milestone is changed to those completed.</p>								
Labor Actuals	Expected														
There are no changes in budget.															
<b>SCHEDULE:</b> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <tr> <th style="width: 30%;">Milestone</th> <th style="width: 30%;">Schedule</th> <th style="width: 40%;">Target</th> </tr> <tr> <td style="padding: 5px;">I. Replace cross-ties</td> <td style="padding: 5px;">9/30/2020</td> <td style="padding: 5px;">9/30/2020</td> </tr> </table>			Milestone	Schedule	Target	I. Replace cross-ties	9/30/2020	9/30/2020	<b>RISK &amp; MITIGATION:</b> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <tr> <th style="width: 50%;">Risk</th> <th style="width: 50%;">Mitigation</th> </tr> <tr> <td style="padding: 5px;">I. Aged and degraded cross-ties could lead to rail failure.</td> <td style="padding: 5px;">I. Identify clusters of bad ties and prioritize their replacement.</td> </tr> </table>			Risk	Mitigation	I. Aged and degraded cross-ties could lead to rail failure.	I. Identify clusters of bad ties and prioritize their replacement.
Milestone	Schedule	Target													
I. Replace cross-ties	9/30/2020	9/30/2020													
Risk	Mitigation														
I. Aged and degraded cross-ties could lead to rail failure.	I. Identify clusters of bad ties and prioritize their replacement.														

9
QSU4 FY2020

**COST:** No impact.

**SCOPE:** Normally 5000 cross-ties are replaced on the VLA railroad track every year. However, the need to re-design the tie replacement procedures to take into account the COVID-safe practices, and the reduced staffing available at the start of the outbreak, meant that only 2344 cross-ties were replaced in FY2020. We propose to close out this milestone at the end of FY2020 with this reduced scope (47% complete).

**SCHEDULE:** No impact.

**RISK & MITIGATION:** The risk of not completing the normal number of cross-tie replacements is the increased probability of rail failure that would limit our ability to safely move antennas. The mitigation in FY2020 was to identify clusters of bad ties that are most likely to fail and prioritize their replacement. This prioritization will continue into FY2021.

## POP MILESTONE # 3.3.38

### NM Operations

#### More smoothing options in correlator

<b>COST:</b>		<b>SCOPE:</b>		
Labor Actuals	Expected	The original scope of this milestone was to implement additional spectral smoothing options in the correlator. It is being cancelled pending further internal review.		
There are no changes in budget.				
<b>SCHEDULE:</b>		<b>RISK &amp; MITIGATION:</b>		
Milestone	Schedule	Target	Risk	Mitigation
I. Add smoothing options	9/30/2020	Cancelled	I. None	I. No mitigation needed

**COST:** No impact.

**SCOPE:** The original intention of this milestone was to provide additional spectral smoothing options in the VLA correlator, to lower data rates and data volumes for continuum projects. However, the impact of introducing such smoothing on the downstream data processing needs to be re-evaluated before proceeding with this project, and its importance relative to other software development needs to be determined. We therefore propose to cancel this milestone.

**SCHEDULE:** Milestone canceled.

**RISK & MITIGATION:** There is no risk in canceling this milestone. Users can apply spectral smoothing during data reduction, if needed.

## POP MILESTONE # 3.3.39

### NM Operations

### Install replacement ACUs #14, 15, 16

Cost

Schedule

Scope

<b>COST:</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%; padding: 2px;">Labor Actuals</th> <th style="width: 50%; padding: 2px;">Expected</th> </tr> <tr> <td colspan="2" style="padding: 5px;">There are no changes in budget.</td> </tr> </table>			Labor Actuals	Expected	There are no changes in budget.		<b>SCOPE:</b> The original plan was to install three additional replacement ACUs on the VLA. The scope of this milestone has been changed to installing two ACUs.								
Labor Actuals	Expected														
There are no changes in budget.															
<b>SCHEDULE:</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 33%; padding: 2px;">Milestone</th> <th style="width: 33%; padding: 2px;">Schedule</th> <th style="width: 33%; padding: 2px;">Target</th> </tr> <tr> <td style="padding: 5px;">1. Complete installation of 2<sup>nd</sup> ACU in FY2020</td> <td style="padding: 5px;">9/30/2020</td> <td style="padding: 5px;">12/30/2020</td> </tr> </table>			Milestone	Schedule	Target	1. Complete installation of 2 <sup>nd</sup> ACU in FY2020	9/30/2020	12/30/2020	<b>RISK &amp; MITIGATION:</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%; padding: 2px;">Risk</th> <th style="width: 50%; padding: 2px;">Mitigation</th> </tr> <tr> <td style="padding: 5px;">1. Inability to operate antenna servo system due to failure of obsolete system</td> <td style="padding: 5px;">1. Maintain stockpile of components and continue installing ACUs on the array as funding and resources permit.</td> </tr> </table>			Risk	Mitigation	1. Inability to operate antenna servo system due to failure of obsolete system	1. Maintain stockpile of components and continue installing ACUs on the array as funding and resources permit.
Milestone	Schedule	Target													
1. Complete installation of 2 <sup>nd</sup> ACU in FY2020	9/30/2020	12/30/2020													
Risk	Mitigation														
1. Inability to operate antenna servo system due to failure of obsolete system	1. Maintain stockpile of components and continue installing ACUs on the array as funding and resources permit.														

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QSU4 FY2020

**COST:** No impact.

**SCOPE:** All legacy VLA ACUs are to be replaced with units using newer technology, including NRAO-developed all-digital Silicon Controlled Rectifiers (SCR), which enable a more supportable VLA, as well as eliminating some inherent problems with the legacy design and greatly improving the pointing and tracking capabilities of the antennas. The original plan was to install three additional units in FY2020. However, the antenna overhaul sequence was disrupted due to COVID operational delays and only two of the antennas planned for ACU replacement entered overhaul in 2020. Future ACU installation work will be captured in an FY2021 POP milestone. The scope of this FY2020 milestone has been changed to completing the installation of two ACUs.

**SCHEDULE:** The need to develop new COVID-safe protocols slowed down all antenna maintenance work in FY2020. Only one ACU replacement was completed by the end of FY2020. The second is being carried over to Q1 FY2021.

**RISK & MITIGATION:** The primary risk is that one of the old ACUs may fail. However, now that 14 have already been replaced, a stockpile of components from the removed older systems is available for handling corrective maintenance needs.



# POP MILESTONE # 3.3.42

## NM Operations

Install network switch power conditioning system on all antennas

Cost




Schedule

Scope

<b>COST:</b> <table> <tr> <th>Labor Actuals</th> <th>Expected</th> </tr> <tr> <td colspan="2">There are no changes in budget.</td> </tr> </table>			Labor Actuals	Expected	There are no changes in budget.		<b>SCOPE:</b> Complete the installation of power conditioning system for network switches on all VLA antennas.								
Labor Actuals	Expected														
There are no changes in budget.															
<b>SCHEDULE:</b> <table> <tr> <th>Milestone</th> <th>Schedule</th> <th>Target</th> </tr> <tr> <td>I. Complete installation of last power conditioning system</td> <td>9/30/2020</td> <td>3/31/2021</td> </tr> </table>			Milestone	Schedule	Target	I. Complete installation of last power conditioning system	9/30/2020	3/31/2021	<b>RISK &amp; MITIGATION:</b> <table> <tr> <th>Risk</th> <th>Mitigation</th> </tr> <tr> <td>I. Minor operations disruption</td> <td>I. Assign staff to stabilize antenna systems affected by network outages.</td> </tr> </table>			Risk	Mitigation	I. Minor operations disruption	I. Assign staff to stabilize antenna systems affected by network outages.
Milestone	Schedule	Target													
I. Complete installation of last power conditioning system	9/30/2020	3/31/2021													
Risk	Mitigation														
I. Minor operations disruption	I. Assign staff to stabilize antenna systems affected by network outages.														

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QSU4 FY2020

**COST:** No impact.

**SCOPE:** A power conditioner assembly has been designed to stabilize battery-provided power delivered to the antenna network switches during power outages. The assembly will be built and tested throughout the fiscal year with all 28 antennas modified by the end of Q4.

**SCHEDULE:** Due to COVID operational delays, the antenna overhauls did not progress according to the original schedule. The final two conditioning systems will be installed on antennas 22 and 20, and will be completed along with their maintenance overhauls in FY2021. We now expect the installations to be completed by the end of Q2 FY2021.

**RISK & MITIGATION:** In case of power outages, staff have been trained on how to stabilize systems effected by network outages. Under typical short-duration outages, this will mostly impact antennas without the power conditioning system installed.

# POP MILESTONE # 3.3.49

## NM Operations

### Plan for future RFI monitoring

Cost




Schedule

Scope

<b>COST:</b> <table> <tr> <th>Labor Actuals</th> <th>Expected</th> </tr> <tr> <td colspan="2">There are no changes in budget.</td> </tr> </table>			Labor Actuals	Expected	There are no changes in budget.		<b>SCOPE:</b> Produce a plan for future RFI monitoring and mitigation from the new satellite constellations for the VLBA.								
Labor Actuals	Expected														
There are no changes in budget.															
<b>SCHEDULE:</b> <table> <tr> <th>Milestone</th> <th>Schedule</th> <th>Target</th> </tr> <tr> <td>I. RFI plan</td> <td>9/30/2020</td> <td>3/31/2021</td> </tr> </table>			Milestone	Schedule	Target	I. RFI plan	9/30/2020	3/31/2021	<b>RISK &amp; MITIGATION:</b> <table> <tr> <th>Risk</th> <th>Mitigation</th> </tr> <tr> <td>I. None</td> <td>I. No mitigation needed</td> </tr> </table>			Risk	Mitigation	I. None	I. No mitigation needed
Milestone	Schedule	Target													
I. RFI plan	9/30/2020	3/31/2021													
Risk	Mitigation														
I. None	I. No mitigation needed														

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QSU4 FY2020

COST: No impact.

SCOPE: No impact.

SCHEDULE: Work on the RFI plan was slower than expected due to the reduced efficiency of working during the pandemic. The completion date is now expected to be Q2 FY2021.

RISK & MITIGATION: The risk of increased RFI impacting correlated data for the VLBA due to the new satellite constellations is reduced for the VLBA by the physical separation of the stations. No mitigation for the delay in the development of the RFI monitoring plan is required at this time.

## POP MILESTONE # 3.3.52

### NM Operations

#### Demonstrate Oryx capabilities in lab

##### COST:

Labor Actuals	Expected
There are no changes in budget.	

##### SCOPE:

The original scope of this milestone was to demonstrate the capabilities of the VLBA's new digital architecture (Oryx) in the lab. This work has now been incorporated into a new project schedule (VNDA), and this milestone is being cancelled.

##### SCHEDULE:

Milestone	Schedule	Target
I. Demonstrate Oryx capabilities	9/30/2020	Cancelled

##### RISK & MITIGATION:

Risk	Mitigation
I. None	I. No mitigation needed

COST: No impact.

SCOPE: The original intention of this milestone was to demonstrate the capabilities of the VLBA's new digital architecture (Oryx) in the lab. However, it became clear during further development of the overall project schedule that this work is more appropriately covered by FY2021 milestone #3.4.54 (Submit VNDA Preliminary Design for Review). We therefore propose to cancel this milestone.

SCHEDULE: Milestone cancelled.

RISK & MITIGATION: There is no risk in canceling this milestone. It is being incorporated into the project schedule for FY2021.

## POP MILESTONE # 3.3.56

### NM Operations

#### Major VLBA Maintenance Visit #2

<b>COST:</b>			<b>SCOPE:</b>	
Labor Actuals	Expected		Major maintenance visit to a second VLBA site for multiple preventive maintenance activities.	
There are no changes in budget.			Due to COVID-related travel restrictions, this milestone has been cancelled.	
<b>SCHEDULE:</b>			<b>RISK &amp; MITIGATION:</b>	
Milestone	Schedule	Target	Risk	Mitigation
I. Completion of maintenance visit	9/30/2020	Cancelled	I. Major maintenance needs arising prior to Tiger Team visit	I. Mobilize and send team for critical maintenance if needed.

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QSU4 FY2020



**COST:** No impact.

**SCOPE:** Inspect VLBA site and antenna, perform major preventive maintenance on all antenna systems, and perform corrective maintenance as needed.

**SCHEDULE:** Due to COVID travel restrictions and safety concerns, the second major maintenance visit originally planned for FY2020 was cancelled.

**RISK & MITIGATION:** In case a major maintenance need arises before a site is visited by the maintenance team, a select group of individuals will be mobilized and sent to respond to the specific problem. This will be managed on a case-by-case basis. (This actually occurred with the failure of an azimuth wheel bearing at VLBA-HN in late September.)

## POP MILESTONE # 3.3.60

### NM Operations

Install upgraded VLBA weather station at one site

Cost

Schedule

Scope

<b>COST:</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%; padding: 2px;">Labor Actuals</th> <th style="width: 50%; padding: 2px;">Expected</th> </tr> <tr> <td colspan="2" style="padding: 5px;">There are no changes in budget.</td> </tr> </table>			Labor Actuals	Expected	There are no changes in budget.		<b>SCOPE:</b> Complete lab integration and install upgraded VLBA weather station system at one VLBA site.										
Labor Actuals	Expected																
There are no changes in budget.																	
<b>SCHEDULE:</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 33%; padding: 2px;">Milestone</th> <th style="width: 33%; padding: 2px;">Schedule</th> <th style="width: 33%; padding: 2px;">Target</th> </tr> <tr> <td style="padding: 5px;">1. Install upgraded VLBA weather station at one site</td> <td style="padding: 5px;">9/30/2020</td> <td style="padding: 5px;">3/30/2021</td> </tr> </table>			Milestone	Schedule	Target	1. Install upgraded VLBA weather station at one site	9/30/2020	3/30/2021	<b>RISK &amp; MITIGATION:</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%; padding: 2px;">Risk</th> <th style="width: 50%; padding: 2px;">Mitigation</th> </tr> <tr> <td style="padding: 5px;">1. Reduced effort available in FY2021 due to ngVLA demands</td> <td style="padding: 5px;">1. Assign additional engineering staff to help in effort.</td> </tr> <tr> <td style="padding: 5px;">2. Existing units may fail</td> <td style="padding: 5px;">2. Maintain adequate stock of obsolete components</td> </tr> </table>			Risk	Mitigation	1. Reduced effort available in FY2021 due to ngVLA demands	1. Assign additional engineering staff to help in effort.	2. Existing units may fail	2. Maintain adequate stock of obsolete components
Milestone	Schedule	Target															
1. Install upgraded VLBA weather station at one site	9/30/2020	3/30/2021															
Risk	Mitigation																
1. Reduced effort available in FY2021 due to ngVLA demands	1. Assign additional engineering staff to help in effort.																
2. Existing units may fail	2. Maintain adequate stock of obsolete components																

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QSU4 FY2020

**COST:** No impact.

**SCOPE:** The replacement candidate VLBA weather station developed in FY2019 will be fully packaged, verified, delivered, and installed at a VLBA site in Q4 FY2020. This is part of a multi-year effort to address the obsolescence of the current station components.

**SCHEDULE:** Due to COVID operational delays, lab software testing and integration of units was delayed four months between March and June. The system is now expected to be installed in Q2 of FY2021.

**RISK & MITIGATION:** A second engineer has been assigned to this effort, in anticipation of additional ngVLA demands on the primary engineer in FY2021. Because the aim of this project is to replace the nearly obsolete weather station, spares for the current system are also being closely tracked.



POP MILESTONE # 3.3.61

NM Operations

Complete Installation of Antenna E-racks

Cost

Schedule

Scope

<div>COST:</div> <table> <tr> <td>Labor Actuals</td> <td>Expected</td> </tr> <tr> <td colspan="2">There are no changes in budget.</td> </tr> </table>			Labor Actuals	Expected	There are no changes in budget.		<div>SCOPE:</div> <div>Complete the mechanical installation of E-racks at all VLBA sites.</div>								
Labor Actuals	Expected														
There are no changes in budget.															
<div>SCHEDULE:</div> <table> <tr> <td>Milestone</td> <td>Schedule</td> <td>Target</td> </tr> <tr> <td>I. Complete installation of all E-racks in VLBA antennas</td> <td>9/30/2020</td> <td>9/30/2021</td> </tr> </table>			Milestone	Schedule	Target	I. Complete installation of all E-racks in VLBA antennas	9/30/2020	9/30/2021	<div>RISK &amp; MITIGATION:</div> <table> <tr> <td>Risk</td> <td>Mitigation</td> </tr> <tr> <td>I. E-racks not in place when needed for new synthesizers.</td> <td>I. Maintain schedule buffer between completion milestone and need date.</td> </tr> </table>			Risk	Mitigation	I. E-racks not in place when needed for new synthesizers.	I. Maintain schedule buffer between completion milestone and need date.
Milestone	Schedule	Target													
I. Complete installation of all E-racks in VLBA antennas	9/30/2020	9/30/2021													
Risk	Mitigation														
I. E-racks not in place when needed for new synthesizers.	I. Maintain schedule buffer between completion milestone and need date.														

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QSU4 FY2020

**COST:** No impact.

**SCOPE:** To continue the expansion of equipment and capabilities on each antenna, a shielded equipment rack will be installed in the upper antenna cabin of all VLBA antennas. As part of a strategic technical roadmap, these racks will eventually house many of the new electronics needed to advance the capabilities of the VLBA.

**SCHEDULE:** Due to COVID travel restrictions, no installation teams were able to visit the remaining six sites that do not yet have E-racks in FY2020. The remaining antennas will be visited throughout FY2021.

**RISK & MITIGATION:** The E-racks are necessary to house new electronics as part of a VLBA upgrade development plan. The schedule has been planned so that the racks have a schedule buffer of one year between installation and their absolute need date.

POP MILESTONE # 4.3.4

Central Development Laboratory

Evaluate upgraded balanced IF amplifiers

Cost

Schedule

Scope

COST: Not Applicable (see notes)

Labor Actuals

Expected

\$

\$

Material Actuals

Expected

\$

\$

Travel Actuals

Expected

\$

\$

SCOPE: Scope has been revised as follows

- Original scope was to install 4-12 GHz superconducting IF hybrids in the balanced amplifier housings after replacing the original MMICs with new improved devices and test the amplifiers. New LNF MMICs are still awaited.
- After the ALMA2020 roadmap publication, new IF requirement is to cover 4-16 GHz, or even 4-20 GHz. Revised superconducting IF hybrids are in the works.
- There is also the alternate possibility of making 4-16 GHz balanced amplifiers using Diramics transistors and the superconducting IF hybrids.

SCHEDULE: Additional schedule required

Milestone

Schedule

Target

1. Test data taken on prototype amplifiers

9/30/2020

9/30/2021

Additional scope and options require another 12 months for the completion of this milestone. Further explanation in notes.

RISK & MITIGATION:

Risk

Mitigation

1. Gain-stable LNF MMICs suitable for this application might not materialize.




1. Alternate Diramics device based MIC amplifier approach has been identified.

2. Superconducting hybrid design risks.

2. After two iterations, a workable superconducting material system configuration has been identified for 4-12 GHz design that should be suitable for 4-16 GHz design.

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QSU4 FY2020

**COST:** Not applicable. Parts/POs for the LNF MMICs are in place. Budget for revised superconducting hybrids is being carried under the Cycle 7 ALMA development study NCE. Budget for Diramics transistor based investigation is being carried by the a new Cycle 8 ALMA development study. Other related design work for the effort will be covered under normal/everyday development work.

**SCOPE:** Original scope was to install 4-12 GHz superconducting IF hybrids in the balanced amplifier housings produced by LNF after replacing the original MMICs (whose gain changes after warm-up cycles) with new improved devices and test the amplifiers. New LNF MMICs are still awaited. After the ALMA2020 roadmap publication, new IF requirement is to cover 4-16 GHz, or even 4-20 GHz. Revised superconducting IF hybrids are in the works. LNF continues to work on stable MMICs. There is also the alternate possibility of making 4-16 GHz balanced amplifiers using Diramics transistors (MIC amplifiers) and the superconducting IF hybrids. Additional time is also required for LNF to deliver their revised MMICs.

**SCHEDULE:** Identified remaining work is expected to consume additional 12 months. Of these 12 months, the first 6 months are required for the redesign and fabrication of new wider-bandwidth IF hybrids (as explained in the ALMA development Cycle 7 Band 6v2 study NCE CRE). The remaining period will be used to implement the and test the prototype balance IF amplifiers towards the completion of this milestone.

**RISK & MITIGATION:** 1) Gain-stable LNF MMICs suitable for this application might not materialize. Alternate Diramics device based MIC amplifier approach has been identified. 2) Superconducting hybrid design risks. After two iterations, a workable superconducting material system configuration has been identified for 4-12 GHz design that should be suitable for 4-16 GHz design.

## POP MILESTONE # 4.3.8

### Central Development Laboratory

### Design SADC drop-in for W-band Front End

COST: Not applicable			SCOPE:	
Labor Actuals	Expected		The deliverable scope of this milestone was to build upon the successful ASIC prototype and design a new circuit board as a drop-in replacement in the already proven W-Band IRD module to enable a performance comparison against the current non-ASIC implementation. Since the ASIC requirements continue to evolve, it is proposed to cancel this milestone.	
\$	\$			
Material Actuals	Expected			
\$	\$			
Travel Actuals	Expected		RISK & MITIGATION:	
\$	\$			
SCHEDULE:				
Milestone	Schedule	Target	Risk	Mitigation
I. Complete (PCB) layout for the ASIC chip.	9/30/2020	Cancelled	I. None	I. No mitigation needed

COST: No impact.

SCOPE: This task was dependent on another (the SADC ASIC itself) that has not completed successfully, and now the funding source for that prerequisite task has shifted their priorities because of considerations of schedule and risk. The scope of this milestone has been subsumed into the newer FY2020I CDL Milestone 4.3.9, so this milestone should be cancelled. We will have to separately cancel the corresponding FY2021 CDL Milestone 4.3.9 milestone as well.

SCHEDULE: It is proposed to cancel the milestone, so there are no additional schedule considerations.

RISK & MITIGATION: No impact.

POP MILESTONE # 5.7.17				<div>Cost</div> <div>Schedule</div> <div>Scope</div>	
Science Support and Research VLASS product delivery schedule					
<b>COST:</b>		<b>SCOPE:</b>			
Labor Actuals	Expected	Decision remains to maintain scientific scope though expansion of processing resources, introducing an inevitable delay and potential increase in cost. Some compromise on image quality may be required to deliver scope under cost constraints.			
\$	\$				
Material Actuals	Expected				
\$ compute resources	\$ under evaluation				
Travel Actuals	Expected				
\$	\$				
<b>SCHEDULE:</b>		<b>RISK &amp; MITIGATION:</b>			
Milestone	Schedule	Target	Risk	Mitigation	
1. Product Delivery Schedule	3/31/2020	12/30/2020	1. Internal compute resources for SE imaging inadequate 2. Algorithmic risk for single epoch products 3. Disengagement of users community	1. External compute resources. CHTC is under test 2. Engagement with ARDG/CASA 3. Transparent communication and expectation management	

**COST:** Single Epoch imaging may be considerably more expensive than predicted. External processing alternatives are being explored. The most promising is the Condor 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:** Update baseline delivery schedule is delayed due to setbacks in testing. Setbacks are transitory in nature and draft delivery schedule is currently being updated for internal review.

#### RISK & MITIGATION:

- 1) 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) VLASS Imaging Project has produced a viable recipe for continuum imaging. Pending larger scale validation, this will retire the algorithmic risk for continuum images. Ongoing work in process to address algorithmic risk for single epoch continuum processing.
- 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.

## POP MILESTONE # 5.7.24

### Science Support and Research CASA v6.2 validation

#### COST:

Labor Actuals	Expected
There are no changes in budget.	

#### SCOPE:

The original scope of this milestone was to validate CASA v6.2. A new milestone has been set by DMS to release both v6.2 and v5.8 in Q1 FY2021 (milestone #6.5.24). Since the validation effort is tied to the CASA releases, there is a corresponding SSR milestone for their validation in Q1 FY2021 (# 5.7.23). Therefore this milestone is being cancelled.

#### SCHEDULE:

Milestone	Schedule	Target
I. Validation for CASA v6.2	9/30/2020	Cancelled

#### RISK & MITIGATION:

Risk	Mitigation
I. None	I. No mitigation needed

**COST:** No impact.

**SCOPE:** The original scope of this milestone was to validate CASA v6.2. However, a new milestone has been set by DMS to release both v6.2 and v5.8 in Q1 FY2021 (milestone #6.5.24). Since the validation effort is tied to the CASA releases, there is a corresponding SSR milestone for their validation in Q1 FY2021 (#5.7.23). We therefore propose to cancel this milestone.

**SCHEDULE:** Milestone cancelled

**RISK & MITIGATION:** There is no risk in cancelling this milestone. It has a new milestone for FY2021.



## POP MILESTONE # 5.7.25

### Science Support and Research CASAGuides for v6.2

#### COST:

Labor Actuals	Expected
There are no changes in budget.	

#### SCOPE:

The original scope of this milestone was to publish CASAGuides for CASA v6.2. A new milestone has been set by DMS to release both v6.2 and v5.8 in Q1 FY2021 (milestone #6.5.24). Since the CASAGuides effort is tied to CASA releases, there is a corresponding SSR milestone for the CASAGuides in Q1 FY2021 (# 5.7.24). Therefore this milestone is being cancelled.

#### SCHEDULE:

Milestone	Schedule	Target
1. CASAGuides for CASA v6.2	9/30/2020	Canceled

#### RISK & MITIGATION:

Risk	Mitigation
1. None	1. No mitigation needed

**COST:** No impact.

**SCOPE:** The original scope of this milestone was to publish CASAGuides for CASA v6.2. However, a new milestone has been set by DMS to release both v6.2 and v5.8 in Q1 FY2021 (milestone #6.5.24). Since the CASAGuides effort is tied to CASA releases, there is a corresponding SSR milestone for the CASAGuides in Q1 FY2021 (#5.7.24). We therefore propose to cancel this milestone.

**SCHEDULE:** Milestone cancelled

**RISK & MITIGATION:** There is no risk in canceling this milestone. It has a new milestone for FY2021.

## POP MILESTONE # 6.6.8

Data Management & Software/SIS  
Completion of VLBA fiber project

Cost  
Schedule  
Scope

<b>COST:</b>			<b>SCOPE:</b>	
Labor Actuals	Expected		No change in scope; all 10 VLBA sites are to be connected to the Internet by fiber optic connections. Los Alamos fiber install was delayed by contract negotiations, then COVID-19 for access to site.	
\$	\$			
Material Actuals	Expected			
\$	\$			
Travel Actuals	Expected			
\$	\$			
<b>SCHEDULE:</b>			<b>RISK &amp; MITIGATION:</b>	
Milestone	Schedule	Target	Risk	Mitigation
I. Los Alamos	Q2 FY2020	Q1 FY2021	I. Los Alamos connected via slow internet service	I. Continue to ship disk packs and use other sites for observations needing real-time data

COST: No impact.

SCOPE: Los Alamos is the last site to receive fiber connectivity.

SCHEDULE: Los Alamos received fiber connectivity in October 2020.

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

## POP MILESTONE # 6.5.12

### Data Management & Software Correlator Data Rate Testing

Cost
  Schedule
  Scope

<b>COST:</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black;">Labor Actuals</td> <td style="width: 50%; border-bottom: 1px solid black;">Expected</td> </tr> <tr> <td colspan="2" style="padding: 2px;"><i>DMS funds this activity at a higher WBS level.</i></td> </tr> <tr> <td style="border-bottom: 1px solid black;">Material Actuals</td> <td style="border-bottom: 1px solid black;">Expected</td> </tr> <tr> <td style="border-bottom: 1px solid black;">\$</td> <td style="border-bottom: 1px solid black;">\$</td> </tr> <tr> <td style="border-bottom: 1px solid black;">Travel Actuals</td> <td style="border-bottom: 1px solid black;">Expected</td> </tr> <tr> <td style="border-bottom: 1px solid black;">\$</td> <td style="border-bottom: 1px solid black;">\$</td> </tr> </table>	Labor Actuals	Expected	<i>DMS funds this activity at a higher WBS level.</i>		Material Actuals	Expected	\$	\$	Travel Actuals	Expected	\$	\$	<b>SCOPE:</b> <p>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.</p>
Labor Actuals	Expected												
<i>DMS funds this activity at a higher WBS level.</i>													
Material Actuals	Expected												
\$	\$												
Travel Actuals	Expected												
\$	\$												
<b>SCHEDULE:</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%; border-bottom: 1px solid black;">Milestone</th> <th style="width: 30%; border-bottom: 1px solid black;">Schedule</th> <th style="width: 40%; border-bottom: 1px solid black;">Target</th> </tr> <tr> <td style="border-bottom: 1px solid black;">1. Test data rates and produce report</td> <td style="border-bottom: 1px solid black;">6/30/2020</td> <td style="border-bottom: 1px solid black;">TBD</td> </tr> </table>	Milestone	Schedule	Target	1. Test data rates and produce report	6/30/2020	TBD	<b>RISK &amp; MITIGATION:</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%; border-bottom: 1px solid black;">Risk</th> <th style="width: 50%; border-bottom: 1px solid black;">Mitigation</th> </tr> <tr> <td style="border-bottom: 1px solid black;">1. None</td> <td style="border-bottom: 1px solid black;">1. No mitigation needed</td> </tr> </table>	Risk	Mitigation	1. None	1. No mitigation needed		
Milestone	Schedule	Target											
1. Test data rates and produce report	6/30/2020	TBD											
Risk	Mitigation												
1. None	1. No mitigation needed												

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QSU4 FY2020

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

**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 MILESTONE # 6.5.13

### Data Management & Software Scheduling Update

Cost

Schedule

Scope

<b>COST:</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black;">Labor Actuals</td> <td style="width: 50%; border-bottom: 1px solid black;">Expected</td> </tr> <tr> <td colspan="2" style="padding: 2px;"><i>DMS funds this activity at a higher WBS level.</i></td> </tr> <tr> <td style="border-bottom: 1px solid black;">Material Actuals</td> <td style="border-bottom: 1px solid black;">Expected</td> </tr> <tr> <td style="border-bottom: 1px solid black;">\$</td> <td style="border-bottom: 1px solid black;">\$</td> </tr> <tr> <td style="border-bottom: 1px solid black;">Travel Actuals</td> <td style="border-bottom: 1px solid black;">Expected</td> </tr> <tr> <td style="border-bottom: 1px solid black;">\$</td> <td style="border-bottom: 1px solid black;">\$</td> </tr> </table>			Labor Actuals	Expected	<i>DMS funds this activity at a higher WBS level.</i>		Material Actuals	Expected	\$	\$	Travel Actuals	Expected	\$	\$	<b>SCOPE:</b>  Provide an update to the ALMA Scheduling software, with a focus on improving observing efficiency and the underlying technology.		
Labor Actuals	Expected																
<i>DMS funds this activity at a higher WBS level.</i>																	
Material Actuals	Expected																
\$	\$																
Travel Actuals	Expected																
\$	\$																
<b>SCHEDULE:</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%; border-bottom: 1px solid black;">Milestone</th> <th style="width: 20%; border-bottom: 1px solid black;">Schedule</th> <th style="width: 50%; border-bottom: 1px solid black;">Target</th> </tr> <tr> <td style="border-bottom: 1px solid black;">1. Scheduling software update</td> <td style="border-bottom: 1px solid black;">9/30/2020</td> <td style="border-bottom: 1px solid black;">12/31/2020</td> </tr> </table>			Milestone	Schedule	Target	1. Scheduling software update	9/30/2020	12/31/2020	<b>RISK &amp; MITIGATION:</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%; border-bottom: 1px solid black;">Risk</th> <th style="width: 50%; border-bottom: 1px solid black;">Mitigation</th> </tr> <tr> <td style="border-bottom: 1px solid black;">1. None</td> <td style="border-bottom: 1px solid black;">1. No mitigation needed</td> </tr> </table>			Risk	Mitigation	1. None	1. No mitigation needed		
Milestone	Schedule	Target															
1. Scheduling software update	9/30/2020	12/31/2020															
Risk	Mitigation																
1. None	1. No mitigation needed																

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QSU4 FY2020

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

**SCOPE:** Provide an update to the ALMA Scheduling software, with a focus on improving observing efficiency and the underlying technology.

**SCHEDULE:** Three factors have combined to drive a change in the schedule 1) focus on the priority of a significant infrastructure redesign, 2) a gap in staffing and then getting a new staff member trained, and 3) a lack of a pull for new software due to the break in ALMA observing. During ALMA planning meetings, it was decided that DSACore, which has traditionally been maintained by data science at the JAO, would transition into the Integrated Computing Team. Software support and maintenance of the DSACore included a preliminary porting to Python 3, defining the interfaces, re-defining the architecture, and refactoring for usability and scalability. This is currently running in a test environment, with an initial delivery planned in Q1 FY2021.

**RISK & MITIGATION:** None needed.

## POP MILESTONE # 6.5.33

### Data Management & Software Archive Retirement

Cost

Schedule

Scope

<b>COST:</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black;">Labor Actuals</td> <td style="width: 50%; border-bottom: 1px solid black;">Expected</td> </tr> <tr> <td colspan="2" style="padding: 2px;"><i>DMS funds this activity at a higher WBS level.</i></td> </tr> <tr> <td style="border-bottom: 1px solid black;">Material Actuals</td> <td style="border-bottom: 1px solid black;">Expected</td> </tr> <tr> <td style="border-bottom: 1px solid black;">\$</td> <td style="border-bottom: 1px solid black;">\$</td> </tr> <tr> <td style="border-bottom: 1px solid black;">Travel Actuals</td> <td style="border-bottom: 1px solid black;">Expected</td> </tr> <tr> <td style="border-bottom: 1px solid black;">\$</td> <td style="border-bottom: 1px solid black;">\$</td> </tr> </table>	Labor Actuals	Expected	<i>DMS funds this activity at a higher WBS level.</i>		Material Actuals	Expected	\$	\$	Travel Actuals	Expected	\$	\$	<b>SCOPE:</b>  The new archive is targeted to become the default in FY2020 with inclusion of VLBA, legacy VLA, and existing GBT data by Q3.				
Labor Actuals	Expected																
<i>DMS funds this activity at a higher WBS level.</i>																	
Material Actuals	Expected																
\$	\$																
Travel Actuals	Expected																
\$	\$																
<b>SCHEDULE:</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%;">Milestone</th> <th style="width: 20%;">Schedule</th> <th style="width: 50%;">Target</th> </tr> <tr> <td>1. Upgrade AAT/PPI software to 3.8.2</td> <td>9/30/2020</td> <td>Complete</td> </tr> <tr> <td>2. Update infrastructure</td> <td>9/30/2020</td> <td>Complete</td> </tr> <tr> <td>3. Complete telescope scope</td> <td>9/30/2020</td> <td>9/30/2021</td> </tr> </table>	Milestone	Schedule	Target	1. Upgrade AAT/PPI software to 3.8.2	9/30/2020	Complete	2. Update infrastructure	9/30/2020	Complete	3. Complete telescope scope	9/30/2020	9/30/2021	<b>RISK &amp; MITIGATION:</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%;">Risk</th> <th style="width: 50%;">Mitigation</th> </tr> <tr> <td>1. Schedule depends on many groups</td> <td>1. Management coordination</td> </tr> </table>	Risk	Mitigation	1. Schedule depends on many groups	1. Management coordination
Milestone	Schedule	Target															
1. Upgrade AAT/PPI software to 3.8.2	9/30/2020	Complete															
2. Update infrastructure	9/30/2020	Complete															
3. Complete telescope scope	9/30/2020	9/30/2021															
Risk	Mitigation																
1. Schedule depends on many groups	1. Management coordination																

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QSU4 FY2020

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

**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. The first two, upgrading the AAT/PPI software and updating the infrastructure have been completed. Completing the telescope scope is carried over as part of a Q4 FY2021 POP goal, milestone #6.5.32.

**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.

POP MILESTONE # 6.5.41

Cost

Schedule

Scope

Data Management & Software

SRDP Wave 2 Software

COST:

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

SCOPE:

Deliver the SRDP (SRAO, Science Ready Archive and Operations) functionality for Wave 2, including workspaces, CARTA integration, and support for collections.

SCHEDULE:

Milestone	Schedule	Target
1. CARTA integration	9/30/2020	12/31/2021
2. Workspaces	9/30/2020	3/31/2021
3. Collections	9/30/2020	6/30/2021

RISK & MITIGATION:

Risk	Mitigation
1. None	1. No mitigation needed

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QSU4 FY2020

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

**SCOPE:** Deliver the SRDP (SRAO, Science Ready Archive and Operations) functionality for Wave 2, including workspaces, CARTA integration, and support for collections.

**SCHEDULE:** Implementation of Wave 2 SSA items was re-prioritized in favor of delivery of other SRDP work, such as VLASS 2.1 and Single Epoch imaging, and has been rescheduled as a set of POP goals for FY2021: CARTA in Q1, Workspaces in Q2, and collection support in Q3 (POP goals 6.5.39, 6.5.37, and 6.5.38).

**RISK & MITIGATION:** N/A, no mitigation.



POP MILESTONE # 6.5.43

Cost

Schedule

Scope

Data Management & Software

Fully Heterogeneous Array Imaging

COST:

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

SCOPE:

Infrastructure code to support correction for antenna-to-antenna variations in primary beams for full polarization imaging will be implemented by Q2 and tested by Q4.

SCHEDULE:




Milestone	Schedule	Target
1. Code implemented	3/30/2020	Complete
2. Testing complete	9/30/2020	9/30/2021

RISK & MITIGATION:

Risk	Mitigation
1. Low operational risk	1. Existing models can be used.

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QSU4 FY2020

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

**SCOPE:** Infrastructure code to support correction for antenna-to-antenna variations in primary beams for Stokes-I (not full polarization) will be implemented by Q2 and tested by Q4.

**SCHEDULE:** Infrastructure code to support correction for antenna-to-antenna variations in primary beams for Stokes-I imaging was implemented, but testing was delayed due to the higher priority of VLASS work in FY2020 and the complexity of the required beam modeling work. Testing is targeted to be complete in Q4 FY2020. This is a FY2021 POP goal, 6.5.41.

**RISK & MITIGATION:** Risk is low for the EVLA. We have other models that work well for Stokes-I and VLASS can use them (and is using them right now) for Stokes-I single epoch imaging goals. ALMA does not have a risk since they aren't using these models yet.

- Cost
- Schedule
- Scope

### Commission Wide-Field Full-Mueller Imaging Algorithm

<b>COST:</b>			<b>SCOPE:</b>		
Labor Actuals	Expected		Continue commissioning of the full-Mueller imaging algorithm to enable wide-field, wide-band full-Stokes imaging.		
<i>DMS funds this activity at a higher WBS level.</i>					
Material Actuals	Expected				
\$	\$				
Travel Actuals	Expected				
\$	\$				
<b>SCHEDULE:</b>			<b>RISK &amp; MITIGATION:</b>		
Milestone	Schedule	Target	Risk	Mitigation	
1. Implementation, integration, verification	3/30/2020	6/30/2021	1. Varying approaches and results	1. For VLASS, treat it as a special case	
2. Testing with real data, publication	9/30/2020	6/30/2021			

SCOPE: Continue commissioning of the full-Mueller imaging algorithm to enable wide-field, wide-band full-Stokes imaging. This effort involves integration of the fully heterogeneous array infrastructure code for antenna pointing corrections and the full-polarization beam modeling code, scientific testing with simulated and real data, and publishing the results of the scientific characterization.

**SCHEDULE:** Implementation, integration and scientific verification was conducted in FY2020, and is actively ongoing. Delays stem from related VLASS full polarization work and the beam modeling work mentioned above, and are difficult to anticipate in this sort of R&D work. The full scope of this task is now expected to be complete in Q3 FY2021. This is a FY2021 POP goal, 6.5.43.

**RISK & MITIGATION:** Since this is a research area, there are risks of delays due to the inherent different approaches to different cases and multiple inconsistent results. Mitigation (for VLASS) might be to treat it as a special case (non-heterogeneous).

## POP MILESTONE # 7.5.10

### Program Management Department Program Management Software Decision



<b>COST: No Change</b>			<b>SCOPE:</b>	
Labor Actuals	Expected		No change in scope. Evaluating candidate ppm tools against current ERP (JD Edwards), and awaiting a decision about potential future ERP.	
\$	\$			
Material Actuals	Expected			
\$	\$			
Travel Actuals	Expected			
\$	\$			
<b>SCHEDULE:</b>			<b>RISK &amp; MITIGATION:</b>	
Milestone	Schedule	Target	Risk	Mitigation
I. Program Management Software Decision	12/31/2019	TBD	I. None	I. No mitigation needed

COST: No impact.

SCOPE: No change.

SCHEDULE: We continue to evaluate the Oracle Prime Cloud software as it continues to develop. A decision will be made in FY2021 in conjunction with a decision on a future ERP.

RISK & MITIGATION: No risk

## POP MILESTONE # 7.5.1 I

Program Management Department  
Program Management Software Implementation

Cost

Schedule

Scope

<b>COST: No Cost Change</b>			<b>SCOPE:</b>	
Labor Actuals	Expected		No change. Awaiting plan to integrate with ERP.	
\$	\$			
Material Actuals	Expected			
\$	\$			
Travel Actuals	Expected			
\$	\$			
<b>SCHEDULE:</b>			<b>RISK &amp; MITIGATION:</b>	
Milestone	Schedule	Target	Risk	Mitigation
I. Program Management Software Implementation	6/30/2020	TBD	I. None	I. No mitigation needed

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QSUA FY2020

COST: No impact.

SCOPE: No change. Awaiting plan to integrate with ERP.

SCHEDULE: We continue to evaluate the Oracle Prime Cloud software as it continues to develop. A decision will be made in FY2021 in conjunction with a decision on a future ERP.

RISK & MITIGATION: No risk

## POP MILESTONE # 7.5.12

Program Management Department  
Multicancha Construction Complete

Cost

Schedule

Scope

<b>COST: No Change</b>			<b>SCOPE:</b>	
Labor Actuals	Expected	No change in scope. COVID Impacts will delay project.		
\$	\$			
Material Actuals	Expected			
\$	\$			
Travel Actuals	Expected			
\$	\$			
<b>SCHEDULE:</b>			<b>RISK &amp; MITIGATION:</b>	
Milestone	Schedule	Target	Risk	Mitigation
1. Multicancha Construction Complete	12/31/2019	TBD	1. COVID 19 Restrictions Continue	1. Monitor

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QSUA FY2020

COST: No impact.

SCOPE: No change.

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.

# POP MILESTONE # 7.5.13

## Program Management Department

### Multicancha JAO Acceptance Complete

Cost




Schedule

Scope

<b>COST: No Change</b>			<b>SCOPE:</b> No change in scope	
Labor Actuals	Expected			
\$	\$			
Material Actuals	Expected			
\$	\$			
Travel Actuals	Expected			
\$	\$			
<b>SCHEDULE:</b>			<b>RISK &amp; MITIGATION:</b>	
Milestone	Schedule	Target	Risk	Mitigation
I. Multicancha JAO Acceptance Completed	03/30/2020	TBD	I. COVID 19 Restrictions Continue	I. Monitor

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QSUA FY2020

COST: No impact.

SCOPE: No change.

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.



POP MILESTONE # 7.5.15

Program Management Department

VLBA Fiber Installation Complete

Cost

Schedule

Scope

<div>COST: No Change</div> <table> <tr> <td>Labor Actuals</td> <td>Expected</td> </tr> <tr> <td>\$</td> <td>\$</td> </tr> <tr> <td>Material Actuals</td> <td>Expected</td> </tr> <tr> <td>\$</td> <td>\$</td> </tr> <tr> <td>Travel Actuals</td> <td>Expected</td> </tr> <tr> <td>\$</td> <td>\$</td> </tr> </table>			Labor Actuals	Expected	\$	\$	Material Actuals	Expected	\$	\$	Travel Actuals	Expected	\$	\$	<div>SCOPE:</div> <div>No change in scope (See Milestone 6.6.8)</div>		
Labor Actuals	Expected																
\$	\$																
Material Actuals	Expected																
\$	\$																
Travel Actuals	Expected																
\$	\$																
<div>SCHEDULE:</div> <table> <tr> <td>Milestone</td> <td>Schedule</td> <td>Target</td> </tr> <tr> <td>I. VLBA Fiber Installation Complete</td> <td>12/31/2019</td> <td>12/31/2020</td> </tr> </table>			Milestone	Schedule	Target	I. VLBA Fiber Installation Complete	12/31/2019	12/31/2020	<div>RISK &amp; MITIGATION:</div> <table> <tr> <td>Risk</td> <td>Mitigation</td> </tr> <tr> <td>I. COVID 19 Restrictions Continue</td> <td>i. Monitor</td> </tr> </table>			Risk	Mitigation	I. COVID 19 Restrictions Continue	i. Monitor		
Milestone	Schedule	Target															
I. VLBA Fiber Installation Complete	12/31/2019	12/31/2020															
Risk	Mitigation																
I. COVID 19 Restrictions Continue	i. Monitor																

34

QSU4 FY2020

COST: No impact.

SCOPE: No change.

SCHEDULE: : Three year no cost extension granted. Hancock NH now complete. Los Alamos will likely complete Q1 FY2020..

RISK & MITIGATION: COVID 19 restrictions continue. Monitor.

## POP MILESTONE # 7.5.16

Program Management Department  
VLBA Fiber Final Report

Cost

Schedule

Scope

<b>COST: No Change</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; padding: 2px;">Labor Actuals</td> <td style="width: 30%; padding: 2px;">Expected</td> <td style="width: 40%;"></td> </tr> <tr> <td style="padding: 2px;">\$</td> <td style="padding: 2px;">\$</td> <td></td> </tr> <tr> <td style="padding: 2px;">Material Actuals</td> <td style="padding: 2px;">Expected</td> <td></td> </tr> <tr> <td style="padding: 2px;">\$</td> <td style="padding: 2px;">\$</td> <td></td> </tr> <tr> <td style="padding: 2px;">Travel Actuals</td> <td style="padding: 2px;">Expected</td> <td></td> </tr> <tr> <td style="padding: 2px;">\$</td> <td style="padding: 2px;">\$</td> <td></td> </tr> </table>			Labor Actuals	Expected		\$	\$		Material Actuals	Expected		\$	\$		Travel Actuals	Expected		\$	\$		<b>SCOPE:</b>  No change in scope (See milestone 6.6.8)		
Labor Actuals	Expected																						
\$	\$																						
Material Actuals	Expected																						
\$	\$																						
Travel Actuals	Expected																						
\$	\$																						
<b>SCHEDULE:</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%; padding: 2px;">Milestone</th> <th style="width: 20%; padding: 2px;">Schedule</th> <th style="width: 50%; padding: 2px;">Target</th> </tr> <tr> <td style="padding: 2px;">I. VLBA Fiber Final Report</td> <td style="padding: 2px;">3/30/2020</td> <td style="padding: 2px;">12/31/2020</td> </tr> </table>			Milestone	Schedule	Target	I. VLBA Fiber Final Report	3/30/2020	12/31/2020	<b>RISK &amp; MITIGATION:</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%; padding: 2px;">Risk</th> <th style="width: 50%; padding: 2px;">Mitigation</th> </tr> <tr> <td style="padding: 2px;">I. COVID 19 Restrictions Continue</td> <td style="padding: 2px;">I. Monitor</td> </tr> </table>			Risk	Mitigation	I. COVID 19 Restrictions Continue	I. Monitor								
Milestone	Schedule	Target																					
I. VLBA Fiber Final Report	3/30/2020	12/31/2020																					
Risk	Mitigation																						
I. COVID 19 Restrictions Continue	I. Monitor																						

35
QSUA FY2020

COST: No impact.

SCOPE: No change.

SCHEDULE: : Three year no cost extension granted. Hancock NH now complete. Los Alamos will likely complete in Q1 FY2021.

RISK & MITIGATION: COVID 19 restrictions continue. Monitor.

## POP MILESTONE # 8.5.6

### Education and Public Outreach

#### Contact Reporter for Deskside Briefing

<b>COST:</b>			<b>SCOPE:</b>	
Labor Actuals	Expected		One each quarter. Milestone is cancelled.	
\$	\$			
Material Actuals	Expected			
\$	\$			
Travel Actuals	Expected			
\$	\$			
<b>SCHEDULE:</b>			<b>RISK &amp; MITIGATION:</b>	
Milestone	Schedule	Target	Risk	Mitigation
I. Contact reporter	Q4	Cancelled	I. None	I. None

36

QSU4 FY2020



**COST:** No impact.

**SCOPE:** These were planned to occur quarterly,

**SCHEDULE:** No impact.

**RISK & MITIGATION:** This new initiative was cancelled due to COVID-related travel. The director continues to make himself available to the press.

# POP MILESTONE # 8.5.13

## Education and Public Outreach

### Publish Style Guide

Cost




Schedule

Scope

<b>COST:</b> <table> <tr> <td>Labor Actuals</td> <td>Expected</td> </tr> <tr> <td>\$</td> <td>\$</td> </tr> <tr> <td>Material Actuals</td> <td>Expected</td> </tr> <tr> <td>\$</td> <td>\$</td> </tr> <tr> <td>Travel Actuals</td> <td>Expected</td> </tr> <tr> <td>\$</td> <td>\$</td> </tr> </table>			Labor Actuals	Expected	\$	\$	Material Actuals	Expected	\$	\$	Travel Actuals	Expected	\$	\$	<b>SCOPE:</b> Create a comprehensive style guide		
Labor Actuals	Expected																
\$	\$																
Material Actuals	Expected																
\$	\$																
Travel Actuals	Expected																
\$	\$																
<b>SCHEDULE:</b> <table> <tr> <th>Milestone</th> <th>Schedule</th> <th>Target</th> </tr> <tr> <td>I. Style guide</td> <td>Q4 FY2020</td> <td>Q2 FY2021</td> </tr> </table>			Milestone	Schedule	Target	I. Style guide	Q4 FY2020	Q2 FY2021	<b>RISK &amp; MITIGATION:</b> <table> <tr> <th>Risk</th> <th>Mitigation</th> </tr> <tr> <td>I. None</td> <td>I. None</td> </tr> </table>			Risk	Mitigation	I. None	I. None		
Milestone	Schedule	Target															
I. Style guide	Q4 FY2020	Q2 FY2021															
Risk	Mitigation																
I. None	I. None																

37

QSU4 FY2020

**COST:** No impact.

**SCOPE:** Create a comprehensive style guide for the various media that the multimedia group is responsible for, including presentations, video, web, brochures, print materials and Zoom backgrounds.

**SCHEDULE:** Although the outline is complete, new use cases, such as AR and VR have arisen and it is still a work in progress. Estimated completion Q2 FY2021.

**RISK & MITIGATION:** No impact.

## POP MILESTONE # 9.4.5

### Computing and Info Services Cyber Security Training

 Cost  
 Schedule  
 Scope

COST:			SCOPE:	
Labor Actuals	Expected		No change in scope with training to be delivered to all staff.	
\$	\$			
Material Actuals	Expected			
\$	\$			
Travel Actuals	Expected			
\$	\$			
SCHEDULE:			RISK & MITIGATION:	
Milestone	Schedule	Target	Risk	Mitigation
I. SANS online training	Q4 FY2020	Q1 FY2021	I. Staff have not taken on-line training for over a year	I. Training is now available and NRAO security briefings were delivered over Zoom in Q4 FY2020 as planned

38

QSUA FY2020



COST: No impact.

SCOPE: All Observatory staff.

SCHEDULE: Commercial Cyber Security online training slipped into October due to COVID-19 and teaching platform updates.

RISK & MITIGATION: Cyber Security briefings were delivered in Q4.

## POP MILESTONE # 9.4.12

### Computing and Info Services

#### Video System end-of-life mitigation

<b>COST:</b>			<b>SCOPE:</b>	
Labor Actuals	Expected		Project to upgrade room-based video conference system was cancelled due to COVID-19 pandemic and the moratorium on in-person meetings.	
\$	\$			
Material Actuals	Expected			
\$	\$			
Travel Actuals	Expected			
\$	\$			
<b>SCHEDULE:</b>			<b>RISK &amp; MITIGATION:</b>	
Milestone	Schedule	Target	Risk	Mitigation
I. Replace video H/W	Q4 FY2020	Cancelled	I. Support for on-site meetings	I. Continue to use Zoom until buildings are occupied and meeting rooms are in use

**COST:** No impact.

**SCOPE:** Room-based video conference systems

**SCHEDULE:** This work will be revisited after the pandemic and once the Observatory has re-defined its collaboration needs

**RISK & MITIGATION:** No risk since room-based video conference systems are not being used during the pandemic



## POP MILESTONE # 10.2.4

Office of Diversity & Inclusion  
NAC Annual Meeting

Cost

Schedule

Scope

<b>COST:</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; padding: 2px;">Labor Actuals</td> <td style="width: 30%; padding: 2px;">Expected</td> <td style="width: 40%;"></td> </tr> <tr> <td style="padding: 2px;">\$</td> <td style="padding: 2px;">\$</td> <td></td> </tr> <tr> <td style="padding: 2px;">Material Actuals</td> <td style="padding: 2px;">Expected</td> <td></td> </tr> <tr> <td style="padding: 2px;">\$</td> <td style="padding: 2px;">\$</td> <td></td> </tr> <tr> <td style="padding: 2px;">Travel Actuals</td> <td style="padding: 2px;">Expected</td> <td></td> </tr> <tr> <td style="padding: 2px;">\$</td> <td style="padding: 2px;">\$</td> <td></td> </tr> </table>			Labor Actuals	Expected		\$	\$		Material Actuals	Expected		\$	\$		Travel Actuals	Expected		\$	\$		<b>SCOPE:</b> <p>The NAC Annual Meeting is typically held in September. Moving the annual meeting to October accommodates feedback from students and mentors that mid-September is too early in the semester to travel to a meeting.</p>		
Labor Actuals	Expected																						
\$	\$																						
Material Actuals	Expected																						
\$	\$																						
Travel Actuals	Expected																						
\$	\$																						
<b>SCHEDULE:</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%; padding: 2px;">Milestone</th> <th style="width: 30%; padding: 2px;">Schedule</th> <th style="width: 40%; padding: 2px;">Target</th> </tr> <tr> <td style="padding: 2px;">I. Annual NAC Meeting</td> <td style="padding: 2px;">9/2020</td> <td style="padding: 2px;">10/11/2020</td> </tr> </table>			Milestone	Schedule	Target	I. Annual NAC Meeting	9/2020	10/11/2020	<b>RISK &amp; MITIGATION:</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%; padding: 2px;">Risk</th> <th style="width: 50%; padding: 2px;">Mitigation</th> </tr> <tr> <td style="padding: 2px;">I. None</td> <td style="padding: 2px;">I. Moving the meeting one month does not affect the purpose and outcome of the meeting.</td> </tr> </table>			Risk	Mitigation	I. None	I. Moving the meeting one month does not affect the purpose and outcome of the meeting.								
Milestone	Schedule	Target																					
I. Annual NAC Meeting	9/2020	10/11/2020																					
Risk	Mitigation																						
I. None	I. Moving the meeting one month does not affect the purpose and outcome of the meeting.																						

40
QSU4 FY2020

**COST:** The cost of the meeting is unaffected by the move to the next fiscal year. **NOTE:** Costs associated with the meeting are reduced significantly due to the transition of the meeting to a virtual format.

**SCOPE:** The virtual format offers expanded opportunities for professional development activities and additional speakers.

**SCHEDULE:** The virtual format reduces the need to compress speaking and professional development opportunities to fit into a single weekend. Rather than hold the meeting over two days, the schedule will expand to span a four-week period.

**RISK & MITIGATION:** The primary goals of the NAC Annual meeting are essentially unaffected by the move from September to October. While the virtual format will be different, we expect that the ultimate goals will be met: (1) allowing the NAC alums, from all sites, to present their research to each other and to invited guests, (2) provide professional development activities, and (3) offer students an opportunity to meet and interact with professionals and other mentors.

## POP MILESTONE # 11.7.15

Human Resources

Deliver Hiring Manager Training

Cost

Schedule

Scope

<b>COST:</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; padding: 2px;">Labor Actuals</td> <td style="padding: 2px;">Expected</td> </tr> <tr> <td style="padding: 2px;">\$</td> <td style="padding: 2px;">\$</td> </tr> <tr> <td style="padding: 2px;">Material Actuals</td> <td style="padding: 2px;">Expected</td> </tr> <tr> <td style="padding: 2px;">\$</td> <td style="padding: 2px;">\$</td> </tr> <tr> <td style="padding: 2px;">Travel Actuals</td> <td style="padding: 2px;">Expected</td> </tr> <tr> <td style="padding: 2px;">\$</td> <td style="padding: 2px;">\$</td> </tr> </table>			Labor Actuals	Expected	\$	\$	Material Actuals	Expected	\$	\$	Travel Actuals	Expected	\$	\$	<b>SCOPE:</b> <div style="padding: 5px;">No change to scope.</div>		
Labor Actuals	Expected																
\$	\$																
Material Actuals	Expected																
\$	\$																
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\$	\$																
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Milestone	Schedule	Target															
1. Training	6/30/2020	Q1 FY2021															
Risk	Mitigation																
1. None	1. None																

41
QSUA FY2020

COST: No impact.

SCOPE: No impact.

SCHEDULE: Training will be delivered in Q1 FY2021. There were significant enhancements made in the Applicant Tracking System that impacted the Hiring Managers. The training was delayed in order to incorporate the new features into the updated training.

RISK & MITIGATION: No risk.

## POP MILESTONE # 12.2.4

Science Communications

Publish 2019 NRAO Annual Report

Cost

Schedule

Scope

<b>COST:</b> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%; padding: 2px;">Labor Actuals</td> <td style="padding: 2px;">Expected</td> </tr> <tr> <td style="padding: 2px;">\$</td> <td style="padding: 2px;">\$</td> </tr> <tr> <td style="padding: 2px;">Material Actuals</td> <td style="padding: 2px;">Expected</td> </tr> <tr> <td style="padding: 2px;">\$</td> <td style="padding: 2px;">\$</td> </tr> <tr> <td style="padding: 2px;">Travel Actuals</td> <td style="padding: 2px;">Expected</td> </tr> <tr> <td style="padding: 2px;">\$</td> <td style="padding: 2px;">\$</td> </tr> </table>			Labor Actuals	Expected	\$	\$	Material Actuals	Expected	\$	\$	Travel Actuals	Expected	\$	\$	<b>SCOPE:</b> No change to scope.		
Labor Actuals	Expected																
\$	\$																
Material Actuals	Expected																
\$	\$																
Travel Actuals	Expected																
\$	\$																
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Milestone	Schedule	Target															
1. Publish report	09/30/2020	12/18/2020															
Risk	Mitigation																
1. None	1. None																

42
QSU4 FY2020

COST: No impact.

SCOPE: No impact.

SCHEDULE: Publication of the 2019 NRAO Annual Report was delayed by the impact of the COVID pandemic. The 130 pages of Annual Report text and illustrations were completed 31 August 2020. Integration of the report text and illustrations with the Annual Report template is underway and will be followed by two rounds of internal review, then publication. The revised date for publication of the 2019 NRAO Annual Report to the NRAO science website is Friday, 18 December 2020.

RISK & MITIGATION: No impact.

POP MILESTONE # 13.6.1

Administration

Certified Meeting Professional examination

Cost

Schedule

Scope

COST:			SCOPE:	
Labor Actuals	Expected		Event Coordinator will pass Digital Event Strategist certification exam instead of Certified Meeting Planner exam.	
\$	\$			
Material Actuals	Expected			
\$	\$			
Travel Actuals	Expected			
\$	\$			
SCHEDULE:			RISK & MITIGATION:	
Milestone	Schedule	Target	Risk	Mitigation
I. DES exam	Q4 FY2020	Q1 FY2021	I. Low risk	I. Q1 exam

43

QSU4 FY2020

**COST:** No impact.

**SCOPE:** Pivot from in-person conferences to virtual meetings: There is a new focus on virtual meetings in response to the shift in working conditions, travel restrictions, and health concerns due to COVID-19. To deepen interest in the subject, reach wider audiences, and achieve the meetings' objectives, we are investing in new technologies to host these meetings and create reusable content. As it becomes safe and reasonable to meet in person again, we will continue to seek out opportunities to leverage this technology, saving time and money while broadening NRAO's influence as well as the accessibility and diversity of participants.

**SCHEDULE:** Exam date is now in Q1 FY2021. Carryover milestone.

**RISK & MITIGATION:** Low risk. New exam date.

## POP MILESTONE # 15.3.4

Spectrum Management  
URSI GASS, Rome

<b>COST:</b>			<b>SCOPE:</b>	
Labor Actuals	Expected		Meeting cancelled.	
\$	\$			
Material Actuals	Expected			
\$	\$			
Travel Actuals	Expected			
\$	\$			
<b>SCHEDULE:</b>			<b>RISK &amp; MITIGATION:</b>	
Milestone	Schedule	Target	Risk	Mitigation
I. URSI Meeting	9/30/2020	Q4 2021	I. None	I. None

COST: No change.

SCOPE: No change.

SCHEDULE: URSI 2020 meeting cancelled.

RISK & MITIGATION: None.





# Milestone Carryover Chart

FY2019				Q1 FY2020			Q2 FY2020			Q3 FY2020			Q4 FY2020		
POP Section	Milestone	Completion Date	New Completion	Cost	Sched	Scope	Cost	Sched	Scope	Cost	Sched	Scope	Cost	Sched	Scope
4.6	Next Generation Very Large Array														
	Conceptual Design and Development														
3.1	Integrated Receiver Development Tests	9/30/2019	None												Cancelled
FY2018				Q1 FY2020			Q2 FY2020			Q3 FY2020			Q4 FY2020		
POP Section	POP Milestone	Completion Date	New Completion	Cost	Sched	Scope	Cost	Sched	Scope	Cost	Sched	Scope	Cost	Sched	Scope
	ngVLA														
4	Conceptual Design & Development														
12	Algorithmic Study released	9/30/2018	6/30/2020												

## FY19 POP MILESTONE # 3.3.60

NM Operations

Major VLBA Maintenance Visit #1

Cost

Schedule

Scope

<b>COST:</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%; padding: 2px;">Labor Actuals</th> <th style="width: 50%; padding: 2px;">Expected</th> </tr> <tr> <td colspan="2" style="padding: 5px;">There are no changes in budget.</td> </tr> </table>			Labor Actuals	Expected	There are no changes in budget.		<b>SCOPE:</b> Major maintenance visit to Los Alamos VLBA site for multiple preventive maintenance activities that require additional staff. There is no change to the scope.								
Labor Actuals	Expected														
There are no changes in budget.															
<b>SCHEDULE:</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 33%; padding: 2px;">Milestone</th> <th style="width: 33%; padding: 2px;">Schedule</th> <th style="width: 33%; padding: 2px;">Target</th> </tr> <tr> <td style="padding: 5px;">1. Completion of maintenance visit</td> <td style="padding: 5px;">6/30/2019</td> <td style="padding: 5px;">9/2/2020</td> </tr> </table>			Milestone	Schedule	Target	1. Completion of maintenance visit	6/30/2019	9/2/2020	<b>RISK &amp; MITIGATION:</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 50%; padding: 2px;">Risk</th> <th style="width: 50%; padding: 2px;">Mitigation</th> </tr> <tr> <td style="padding: 5px;">1. Azimuth two wheel assembly failure</td> <td style="padding: 5px;">1. Routine monitoring of assembly performance and lubrication quality. Send separate team for assembly swap if needed.</td> </tr> </table>			Risk	Mitigation	1. Azimuth two wheel assembly failure	1. Routine monitoring of assembly performance and lubrication quality. Send separate team for assembly swap if needed.
Milestone	Schedule	Target													
1. Completion of maintenance visit	6/30/2019	9/2/2020													
Risk	Mitigation														
1. Azimuth two wheel assembly failure	1. Routine monitoring of assembly performance and lubrication quality. Send separate team for assembly swap if needed.														

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QSU4 FY2020

COST: No change.

SCOPE: No change.

**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. Restrictions to travel and travel logistics imposed by COVID complicated the maintenance visit to Los Alamos. It was completed by conducting a series of one day maintenance trips to the site from Socorro. The work was completed on Sep 2, 2020. The azimuth wheel assembly will be replaced at a future date.

**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.

FY19 POP MILESTONE # 4.6.22				<div>Cost</div> <div>Schedule</div> <div>Scope</div>	
ngVLA Antenna Optical Design					
<b>COST:</b>		<b>SCOPE:</b>			
Labor Actuals	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 $G/T_{SYS}$ with Gaussian feed horns.			
\$	\$				
Material Actuals	Expected				
\$	\$				
Travel Actuals	Expected				
\$	\$				
<b>SCHEDULE:</b>		<b>RISK &amp; MITIGATION:</b>			
Milestone	Schedule	Target	Risk	Mitigation	
I. Revised optical design	3/30/2019	9/28/2020	I. Less than optimal aperture efficiency and/or a late optical design introduces major structural changes to the antenna.	I. Ensure the optical design is optimized prior to the completion of a detailed mechanical design of the antenna	

COST: No change

SCOPE: No change

**SCHEDULE:** The antenna optical design is complete. The design is described in “18-meter Antenna Optics Definition” (ngVLA document number 20.25.01.00.00-0006-DSN). The document was completed on Sep 28, 2020, and was included as a reference in the recent request for proposal for the Final Design and Prototype of the ngVLA antenna. The design work was done by EMSS.

**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.

## FY19 POP MILESTONE # 4.6.3I

ngVLA

Integrated Receiver Development Test

<b>COST:</b>			<b>SCOPE:</b>	
Labor Actuals	Expected		The Integrated Receiver concept combines downconversion, sampling, and data transmission in a light weight, compact package that offers advantages in cost, performance, and reliability. The performance of the Integrated Receiver chip will be characterized with a demonstration board.	
\$	\$			
Material Actuals	Expected			
\$	\$			
Travel Actuals	Expected			
\$	\$			
<b>SCHEDULE:</b>			<b>RISK &amp; MITIGATION:</b>	
Milestone	Schedule	Target	Risk	Mitigation
1. Complete tests of the Integrated Receiver chip on a demonstration board.	9/30/2019	Cancelled	1. ASIC does not perform as designed	1. Revise the design to correct shortcomings revealed in the characterization tests. 2. Adopt the discrete component design, which will require more space and cooling.

49

QSU4 FY2020



**COST:** No change

**SCOPE:** 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 chip resumed, but the chip performance could not be verified due to the vendor's unrecoverable errors. The effort with this vendor has come to a close, and this milestone is being cancelled as a result. A second attempt at verifying the chip performance with a new vendor may be undertaken in FY2021.

**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.

## FY19 POP MILESTONE # 6.7.17

Science Support and Research (SRDP)

SRDP Pilot Operations Complete



<b>COST:</b>		<b>SCOPE:</b>  Pilot operations were declared complete with the transition to Wave-I operations. July 28, 2020.	
Labor Actuals	Expected		
\$	\$ no change		
Material Actuals	Expected		
\$	\$ no change		
Travel Actuals	Expected		
\$	\$ no change		
<b>SCHEDULE:</b>		<b>RISK &amp; MITIGATION:</b>	
Milestone	Schedule		Target
I End of Pilot Ops	9/30/2019		7/31/2020

COST: No change

SCOPE: No change.

SCHEDULE: Delay in the transition to operations led to the extension of the Pilot period. This is now complete

RISK & MITIGATION: Milestone is complete, no remaining risks.

# FY18 POP MILESTONE # 4.12

ngVLA

Algorithmic Study

## COST:

Labor Actuals	Expected
\$	\$
Material Actuals	Expected
\$	\$
Travel Actuals	Expected
\$	\$

## SCOPE:

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

## SCHEDULE:

Milestone	Schedule	Target
I. Algorithm study released (report/memo)	6/30/2019	12/31/2020

## RISK & MITIGATION:

Risk	Mitigation
I. Under-estimation of the computational resources required by the project.	<ol style="list-style-type: none"> <li>1. Maintain focus of key staff involved on this activity.</li> <li>2. Characterize the estimation uncertainty in the ngVLA reference design and define adequate contingency budget for DS2020.</li> </ol>

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COST: No impact.

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 since been completed. A draft memorandum documenting the algorithm study has been written, and was recently internally reviewed. Once the review comments have been incorporated into the memorandum, it will be published in Q1 FY2021. Contending with COVID over the last two quarters has also delayed the memo's review and 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.



# FY15 POP MILESTONE # 3.4.62

## Admin (from NM Ops)

### Renew VLBA lease for Owens Valley

Cost
  Schedule
  Scope

<b>COST:</b> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <tr> <td style="width: 30%; padding: 5px;">Current VLBA lease rate:</td> <td style="padding: 5px;">\$500 per year</td> </tr> <tr> <td style="padding: 5px;">Expected new lease rate:</td> <td style="padding: 5px;">OVRO hopes to negotiate a lease with LADWP such that the VLBA share is &lt; \$3,000 a year.</td> </tr> </table>			Current VLBA lease rate:	\$500 per year	Expected new lease rate:	OVRO hopes to negotiate a lease with LADWP such that the VLBA share is < \$3,000 a year.	<b>SCOPE:</b> <p>Owens Valley, CA site sub-lease with Owens Valley Radio Observatory (OVRO) is lapsed. OVRO reported on 10/08/2020: "I met with LA DWP and Caltech Office of General Counsel again in the last week. There was a bit of an impasse on the language used for the lease between Caltech General Counsel and the legal team of LA DWP but they are working through it. The process has taken a very long time and I can't confirm when it will be completed. I can only hope that it is soon."</p>										
Current VLBA lease rate:	\$500 per year																
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<b>SCHEDULE:</b> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="width: 30%;">Milestone</th> <th style="width: 30%;">Schedule</th> <th style="width: 30%;">Target</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">1. Owens Valley Lease renewed</td> <td style="padding: 5px;">3/31/2015</td> <td style="padding: 5px;">TBD</td> </tr> </tbody> </table>			Milestone	Schedule	Target	1. Owens Valley Lease renewed	3/31/2015	TBD	<b>RISK &amp; MITIGATION:</b> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr> <th style="width: 50%;">Risk</th> <th style="width: 50%;">Mitigation</th> </tr> </thead> <tbody> <tr> <td style="padding: 5px;">1. Impact on VLBA operating budget (increase in lease cost – but early indications are for a modest increase)</td> <td style="padding: 5px;">1. Adjust VLBA Operating budget, if necessary.</td> </tr> <tr> <td style="padding: 5px;">2. Impact on VLBA operation</td> <td style="padding: 5px;">2. Avoid by periodic follow up of Caltech negotiation progress</td> </tr> </tbody> </table>			Risk	Mitigation	1. Impact on VLBA operating budget (increase in lease cost – but early indications are for a modest increase)	1. Adjust VLBA Operating budget, if necessary.	2. Impact on VLBA operation	2. Avoid by periodic follow up of Caltech negotiation progress
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Updated 10/9/2020

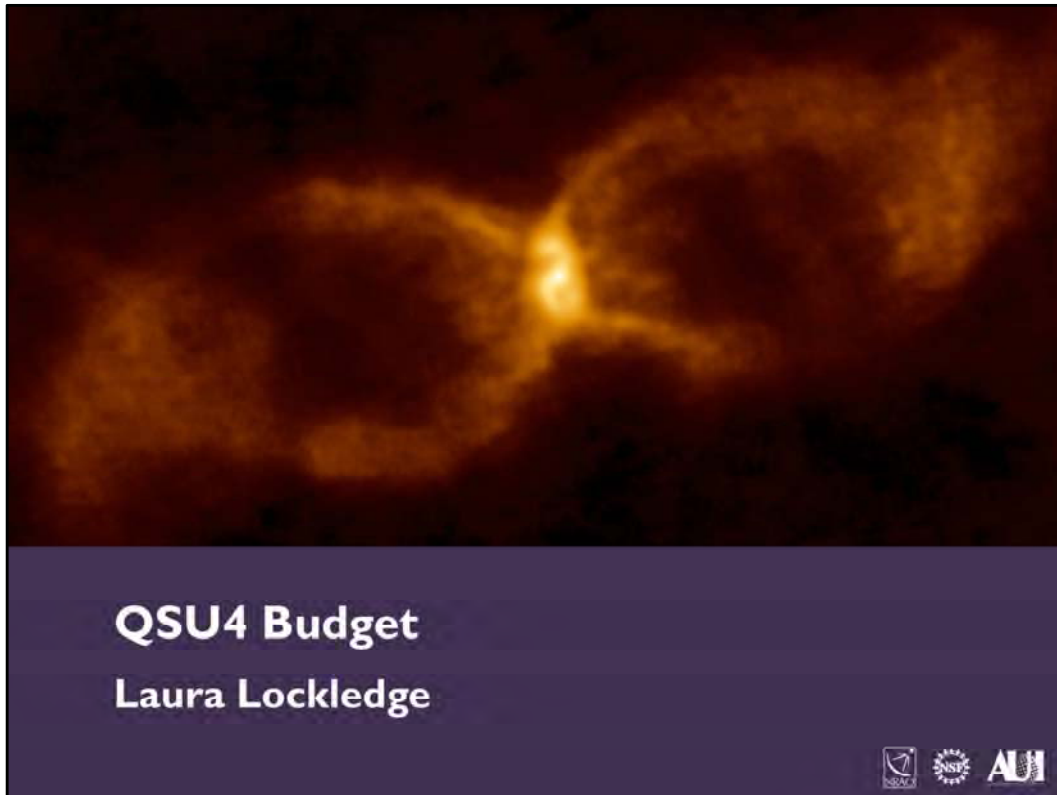
**COST:** Future lease costs are subject to the status of Caltech's re-negotiation of the lease with Los Angeles Water and Power.

**SCOPE:** No changes.

**SCHEDULE:** Owens Valley Lease: 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..

**RISK & MITIGATION:**

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



## FY2020 General Comments

- All programs ended the year within budget.
- ICC (revised rates) ended the year with an over-recovery of \$428K across the four pools.
- Benefits rate, originally @ 61.75%, re-rate to 58.5%, final rate is 57.7% yielding an over-recovery of \$336K. Reflects significant underspends in employee welfare benefits (health, dental, wellness) as well as planned + opportunistic payment against the vacation backlog (\$1.5M).

## FY2020 COVID Impacts & Response: Non-salary

	CSA-A	CSA-V	CSA-L	CSA-N	ICC	Total
Communications	1,638	1,168			1,392	4,198
Computer Hardware	1,896	4,111	165		2,131	8,302
Conf/Seminar Registration	17	1,244			100	1,361
Domestic Travel	760	160,881	10,569	706	4,087	177,004
Foreign Travel	23,885	9,472			-	33,357
Supplies	4,658	15,706	489		52,344	73,196
Travel Relocation		13,299				13,299
<b>Grand Total</b>	<b>32,853</b>	<b>205,881</b>	<b>11,223</b>	<b>706</b>	<b>60,054</b>	<b>310,718</b>

Domestic travel includes commuting support to VLA site.

Supplies includes PPE.

## FY2020 COVID Impacts & Response: Salary 3/13-10/9

Pay Code	TOTAL		Post IDOS	
	Hours	Cost	Hours	Cost
Site Worked	133,620	6,399,288	121,766	5,313,991
Non-Worked	71,328	3,067,594	3,924	182,692
Remote/WFH	313,451	23,236,701	199,890	14,779,940
<b>TOTALS</b>	<b>518,399</b>	<b>32,703,583</b>	<b>325,579</b>	<b>20,276,623</b>
Type	Hours	%	Hours	%
Site Worked	447,071	74%	321,655	83%
Non-Worked	71,328	12%	3,924	1%
Leave	62,973	10%	45,384	12%
Other	26,122	4%	18,271	5%
<b>Total</b>	<b>607,494</b>	<b>100%</b>	<b>389,234</b>	<b>100%</b>

- Includes all AUI Observatories
- Post IDOS (from 6/5) non-worked time typically 1% per pay period. Includes quarantine and facilities access limitations.

## CSA-V FY2020 Final (10/23/2020)

	FY20 POP Budget	FY20 Rev. Budget	FY20 YTD Expenses	YTD % Rev Budget
NSF	34,970	38,470	40,784	106.0%
Carryforward/Other	0	8,082	8,082	0.0%
<b>Total Revenues</b>	<b>34,970</b>	<b>46,552</b>	<b>48,866</b>	<b>105.0%</b>
Telescope Ops	10,841	11,822	10,712	90.6%
Development	3,606	2,846	2,679	94.1%
Science Ops	7,400	9,086	8,065	88.8%
Admin Services	9,863	15,249	9,847	64.6%
Director's Office	2,469	2,920	2,393	82.0%
Ed. & Public Outreach	791	803	761	94.8%
ngVLA	0	3,837	3,241	84.5%
<b>FY20, Total</b>	<b>34,970</b>	<b>46,563</b>	<b>37,698</b>	<b>81.0%</b>
<b>FY20 CSA-V Net</b>	<b>0</b>	<b>-11</b>	<b>11,168</b>	

NSF funding inclusive of \$3.5M NRDZ award and \$2.3M prefunding.



## CSA-V FY2020 Balance Management

\$K	Description
11,168	CSA-V 9/30 Balance
(1,723)	Open Commits
(2,302)	NSF Prefund
(400)	FY19 ICC Reserve
(3,502)	NRDZ Program
<b>3,241</b>	<b>FY20 Programmatic Close Position</b>

\$4M from CSA-V has been committed to FY2021 ngVLA activities.

## CSA-A FY2020 Final (10/23/2020)

	FY20 POP Budget	FY20 Rev. Budget	FY20 YTD Expenses	YTD % Rev Budget
NSF	47,260	47,269	52,199	110.4%
Carryforward	6,158	6,824	6,824	100.0%
Canadian Contribution	1,787	0	0	0.0%
Other	844	1,956	1,956	100.0%
<b>Total Revenues</b>	<b>56,049</b>	<b>56,049</b>	<b>60,979</b>	<b>108.8%</b>
Telescope Ops	28,310	22,600	17,590	77.8%
Development	3,181	10,142	1,143	11.3%
Science Ops	7,158	7,138	6,880	96.4%
Admin Services	8,744	10,912	8,981	82.3%
Director's Office	3,446	3,812	2,975	78.0%
Education & Public Outreach	761	771	697	90.4%
<b>FY20, Total</b>	<b>51,600</b>	<b>55,375</b>	<b>38,266</b>	<b>69.1%</b>
<b>FY20 CSA-A Net</b>	<b>4,449</b>	<b>674</b>	<b>22,713</b>	

- NSF Funding includes \$4.9M in forward funding.
- No major development programs running in FY2020.
- Significant "savings" in JAO operations due to COVID shutdown and exchange rates.

## CSA-A FY2020 Balance Management

Variance Reconciliation	
Budget vs. NSF Variance	22,712,605.50
<b>Adjustments</b>	
NSF Fwd Funding	(4,930,000.00)
ngVLA Contribution	(6,000,000.00)
Development	(7,249,624.24)
FY20 PY Commitment Budgets	(1,343,566.69)
B1 NAOJ	(1,040,000.00)
Multicancha	(747,685.29)
JAO Office Move	(616,239.98)
NSF Fwd Funded JAO	(393,122.05)
ALMA Reserves (Multicancha)	(392,367.25)
<b>Difference</b>	<b>(0.00)</b>

## CSA-A Canadian Funds @ NSF 9/30/2020

Canadian Balance at NSF	Amount
CY14 Q2 & Q3	679
CY2014 Q4 & CY15 Q1	742
Passthru (CSA-2 Amd. 33)	(1,115)
CY15 Q2 & Q3	683
CY15 Q4 & CY16 Q1	546
CY16 Q2 & Q3	548
CY16 Q4 & CY17 Q1	738
CY17 Q2 & Q3	587
CY17 Q4 & CY18 Q1	715
CY18 Q2 & Q3	785
CY18 Q4 & CY19 Q1	649
CY19 Q2 & Q3	779
CY19 Q4 & CY20 Q1	677
CY20 Q2 & Q3	501
<b>TOTAL</b>	<b>7,513</b>

## CSA-L FY2020 Final (10/23/2020)

	FY20 POP Budget	FY20 Rev. Budget	FY20 YTD Expenses	YTD % Rev Budget
NSF	3,430	3,760	4,617	122.8%
Telescope Time Sales	4,614	5,009	4,939	98.6%
Carryforward	71	128	127	
Other	333	624	332	53.1%
<b>Total CSA-L Revenues</b>	<b>8,448</b>	<b>9,521</b>	<b>10,015</b>	<b>105.2%</b>
Telescope Ops	5,311	6,325	5,080	80.3%
Development				
Science Ops				
Admin Services	2,673	2,576	2,733	106.1%
Director's Office	464	564	519	92.0%
Education & Public Outreach				
<b>FY20</b>	<b>8,448</b>	<b>9,465</b>	<b>8,332</b>	<b>88.0%</b>
<b>FY20 CSA-L Net</b>	<b>0</b>	<b>56</b>	<b>1,683</b>	

## CSAs F & H FY2020 Final (10/23/2020)

	CSA H	ITD		CSA-F	ITD	%	CSA-N	ITD	
	Budget	Expenses	% Budget	Budget	Expenses	Budget	Budget	Expenses	% Budget
NSF	2,000	1,976	98.8%	2,500	1,235	49.4%	4,000	3,360	84.0%

- CSA-H is now closed.
- CSA-F is on plan to continue fiber support to the VLBA.
- CSA-N carryforward will support ngVLA activities in FY2021.



## ICC FY2020 Final (10/23/2020)

	FY20 POP Budget	FY20 Rev. Budget	FY20 YTD Expenses	YTD % Rev Budget
NRAO Recoveries	17,271	17,222	15,728	91.3%
External Recoveries	1,445	1,445	1,613	111.6%
<b>Total ICC Revenues</b>	<b>18,716</b>	<b>18,667</b>	<b>17,341</b>	<b>92.9%</b>
Telescope Ops	109	110	156	141.8%
Development	484	484	458	94.6%
Science Ops	2,841	2,819	2,645	93.8%
Admin Services	13,158	12,890	11,769	91.3%
Director's Office	2,124	2,364	1,885	79.7%
<b>FY20, Total</b>	<b>18,716</b>	<b>18,667</b>	<b>16,913</b>	<b>90.6%</b>
<b>FY20 ICC Net</b>	<b>0</b>	<b>0</b>	<b>428</b>	

- Over-recovery of \$428K.
- Director's Office savings due to mid-year fringe rate reduction.



## Education and Public Outreach STEAM Education/Visitor Center



168 Attended via Zoom

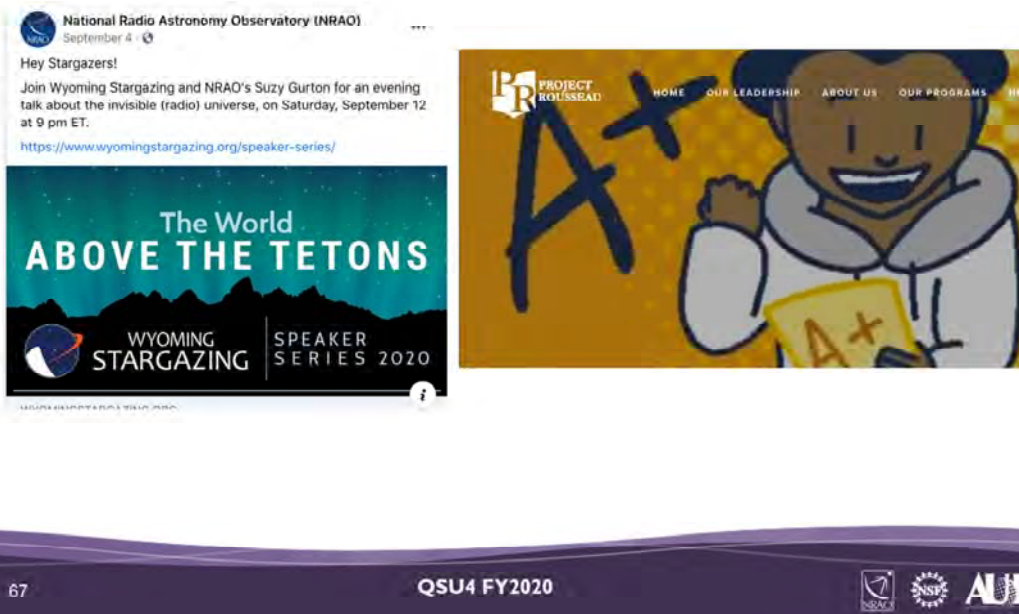


1210 Attended via Zoom

Tours made the pivot to virtual with a virtual tour each month in August and September.


## Education and Public Outreach

### STEAM Education

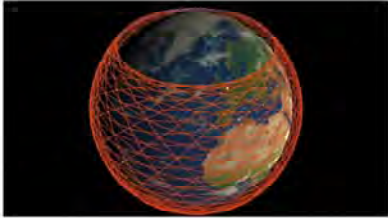


Outreach also moved virtual with talks for the Wyoming Stargazing group, with 24 in attendance and for the Project Rousseau, a program in NYC that provides resources and mentors for underrepresented kids. They have built their program around more in-person interactions, but they invited our two educators, Faith Vowler and Summer Ash, to present to a group of students, 12, to discuss their own STEM journeys.

## Education and Public Outreach News Group supporting STEAM Ed



**The Albuquerque  
Astronomical Society**  
Community Organization



### So ... How'd It Go?


#### The 1st TAAS Virtual General Meeting & Astronomy 101

*By Lynne Olson*

September 5<sup>th</sup>, was our first "double header" virtual meeting on Zoom, and a rewarding adventure for all who participated.

Like the countless American schoolkids forced online to do their homework and learn from teachers seen only on a screen, so TAAS members (though many of them knowledgeable about the medium) had to deal with the sometimes less-than-perfect images.

It was, of course, a unique experience for most of us, although we'd better get used to it, given the dim prospects for an end to the Covid-19 pandemic any time soon.




After a certain amount of tweaking the medium, the evening began with TAAS Astronomy 101 – a presentation of "Double Stars" by Dee Friesen, one of our club's notable experts on observing these always-beautiful artifacts of the cosmos. You can find more on this on our website, [www.taas.org](http://www.taas.org). Look for the "Double Stars Virtual Observing program."

The evening's headline speaker, Dr. Amy Mioduszewski of the National Radio Astronomy Observatory, followed with "Death and Afterlife of Stars," laying out the lifeline of two levels of stars, massive and low mass, and how they develop into supernovae, planetary nebulae, neutron stars and

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QSU4 FY2020



In August, Dave Finley was the featured speaker for the Albuquerque Astronomical Society's first virtual meeting of the COVID era. They had not held a meeting since March. He had committed to the August 8 date back late last year. "In discussions with their VP, who is in charge of programs, I suggested, based on our NRAO experiences, that they might want to try meetings via Zoom. He bought a Zoom license, and I got on Zoom with him a couple weeks in advance and coached him on how to use it. We then did the meeting for the members on the scheduled date, and it worked well.

The speaker for their second virtual meeting, on Sept. 5, was Amy Mioduszewski. Prior to her appearance, we spoke about my experience and the mechanics of the virtual meeting. At her request, I provided her a copy of my slides so she could avoid repeating material about the VLA that I already covered. Her talk, too, was well received."

Dave also created a short training for the tour guides and STEAM Ed team on the talking points around the mounting concern about how Starlink may compromise our ability to do science. He worked with our director to finalize the talking points.

Iris, our ALMA PIO, had made the decision early not to participate in the ESO/JAO press release on the reported detection of Phosphine in the atmosphere of Venus. She worked with NAASC to develop specific talking points for an NRAO representative, in case we received any questions from American press on the detection, to appropriately state our skepticism and emphasize the interesting process of science that has checks and balances that will test the result.



## Education and Public Outreach

### News: NRAO



#### Featured Video: Measuring the Expanding Universe

*Embargoed for release on August 14, 2020 at 2:00 am | News Feature*

Join Melissa Hoffman of the National Radio Astronomy Observatory as she explains how astronomers are using new observations to answer a cosmic mystery.



#### The Cold Case of Carbon Monoxide

*August 19, 2020 at 10:00 am | News Feature*

Fifty years ago, astronomers discovered carbon monoxide in space. It allowed us to see dark regions of the universe, and helped us understand it more clearly.

We had 14 press products last quarter







## Education and Public Outreach

### News in Chile

**Sept, 22nd: "PROVOCA VALPARAÍSO" REUNIÓ A NIÑAS DE LA QUINTA REGIÓN CON MENTORAS CIENTÍFICAS**

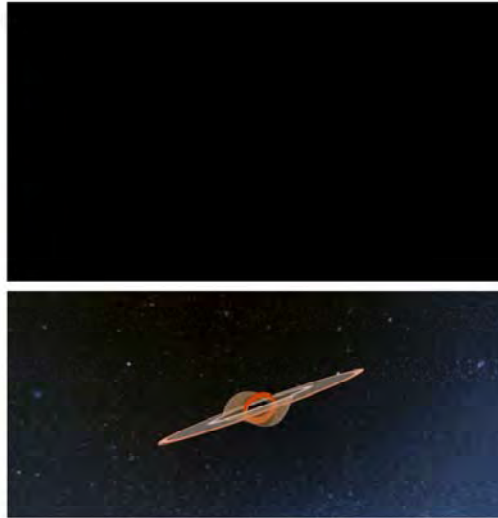
Provoca campaign where we described the latest event, a virtual event with female mentors and high school girls mainly from the Valparaiso region

**Sept. 23rd: ESTRENAN ESPECTÁCULO VIRTUAL SOBRE OBSERVATORIOS "ASTRONOMÍA A GRAN ESCALA"**

A Spanish version of Tim Spuck's Big Astronomy announcement

## Education and Public Outreach

### Multimedia Group



## Education and Public Outreach Multimedia Group



Nan Janney mentored a social media intern this quarter. Sadie Coffin is an alum of the same undergrad program as Adele Plunkett, so made the connection with us through her. She took the lead on setting up the Facebook Live event with artist/astronomer Tyler Nordgren and she also worked with the rest of the multimedia group to prioritize videos that might be of public interest from Vimeo to YouTube. YouTube is used like a search engine by many and we wanted to have content there for more visibility. We started with all the press release videos and Explorer videos. It was a tremendously successful experiment to have a teleworking intern, it helped us with a load of work, and it gave her a new perspective on the observatory. In addition to her work with EPO, she also had check-ins with Adele throughout the summer.

## Education and Public Outreach

Coming in FY2021 Q1...





[science.nrao.edu](http://science.nrao.edu)  
[public.nrao.edu](http://public.nrao.edu)  
[ngvla.nrao.edu](http://ngvla.nrao.edu)

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