Project Lexicon and Acronyms

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Change Record

VERSION	DATE	AUTHOR	REASON
1	2017-11-15	R. Treacy	Initial Draft
2	2018-09-30	R. Treacy	Added Additional Acronyms
3	2018-11-14	S. Leff	Added LBA
4	2019-07-03	A. Lear	Formatting & copy-editing to prepare document for further revision (no text in Sections 1–4); added comments to Lexicon asking for clarification or revision.
5	2019-07-29	R. Selina, R. Carver	Updating to include acronyms and definitions used in the reference design. Updated template content.
A	2019-08-01	A. Lear	Prepared PDF for signatures and release.

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1 Introduction

1.1 Purpose

This document provides a single compendium of acronyms and definitions used in the ngVLA project. Providing a master reference for definitions aims to standardize the use of these terms across the project team.

This is a living document that will be updated throughout the project lifecycle.

1.2 Scope

This document is applicable to all ngVLA deliverables. All project personnel should adhere to these definitions across project documentation.

The ngVLA Project Lexicon will be maintained by Systems Engineering.

2 Related Documents

2.1 Applicable Documents

The following documents are applicable to the extent specified:

Reference No.	Document Title	Rev/Doc. No.
AD01	ngVLA Systems Engineering Management Plan	020.10.00.00.00-0001-PLA

3 Abbreviations and Acronyms

Acronym	Meaning
AAB	Antenna Assembly Barn (VLA)
AAS	American Astronomical Society
AAT	Archive Access Tool
ACFH	Axially Corrugated Feed Horn
ACU	Antenna Control Unit
AD	Assistant Director / Applicable Document
ADC	Analog to Digital Converter
AE	Antenna Element
AEC	Architecture, Engineering and Construction
AIPS	Astronomical Image Processing Software
AIV	Assembly, Integration, and Verification
ALMA	Atacama Large Millimeter–Submillimeter Array
AMBSI	ALMA Monitor and Control Bus Standard Interface
AOC	Array Operation Center
API	Application Programming Interface
APM	Atmospheric Phase Monitor
ARCS	Advanced RFI Containment System
AST	Division of Astronomical Sciences (NSF)
AU	Astronomical Unit
AUI	Associated Universities Inc.
AWS	Amazon Web Services
BDF	Binary Data Format
BDP	Basic Data Product
BE	Back End
BH	Black Hole
BW	Band Width
CA	Cooperative Agreement
CAP	Contracts and Procurement
CATE	Cost and Technical Evaluation (Astro2010)
CASA	Common Astronomy Software Applications
CBE	Correlator Back End
CBF	Correlator Beam-Former
CCB	Change Control Board
CDL	Central Development Laboratory
CDP	Central Data Processor
CDR	Critical Design Review
CIS	Computing Information Services
CMMS	Computerized Maintenance Management System
CoDR	Conceptual Design Review
ConOps	Concept of Operations
COTS	Commercial Off-the Shelf
CRE	Change Request
CS	Computing/Software

Acronym	Meaning
CSA	Continuing Support Agreement
CSIRO	Commonwealth Scientific and Industrial Research Organization
CSP	Central Signal Processor
CSV	Commissioning and Science Validation
CSW	Computing and Software
CV	Charlottesville (NRAO)
CW	Continuous Wave (Sine wave of fixed frequency and amplitude)
DAC	Digital to Analog Converter
DB	Database
DBE	Digital Back End
DC	Direct Costs
DMS	Database Management and Software
DO	Director's Office
DOORS	Dynamic Object Oriented Requirements System
DR	Dynamic Range
DSP	Digital Signal Processing
DTS	Digital Transmission System
ECO	Engineering Change Order
EDFA	Erbium-Doped Fiber Amplifiers
EDMS	Electronic Document Management System
EDP	Enhanced Data Products
EIA	Electronics Industries Association/Electronics Industries Alliance
EIRP	Effective Isotropic Radiated Power
EMC	Electro-Magnetic Compatibility
EMI	Electro-Magnetic Interference
ENOB	Effective Number of Bits
EOC	Extension and Optimization of Capabilities
EPO	Education and Public Outreach
ES	Early Science
ESS	Environmental Safety and Security
ETK	Electronic Time Keeping
EVM	Earned Value Management
FE	Front End (Subsystem)
FIT	Failures in Time
FITS	Flexible Image Transport System
FLS	First Look Science
FMECA	Failure Modes Effects and Criticality Analysis
FOV	Field of View
FSA	Frequency Slice Architecture
FTE	Full Time Equivalent
FWHM	Full Width Half Max
GBO	Green Bank Observatory
GBT	Green Bank Telescope
GM	Gifford-McMahon
GMC	Giant Molecular Clouds

Acronym	Meaning
GPIO	General Purpose Input–Output
GW	Gravitational Wave
HPC	High Performance Computing
HR	Human Resources
HVAC	Heating, Ventilation & Air Conditioning
I2C	Inter-Integrated Circuit (Interface)
ICC	Internal Common Costs
ICD	Interface Control Document
IDC	Indirect Costs
IF	Intermediate Frequency / Interface
IMS	Integrated Master Schedule
IPC	Institute for Packaging Electronic Components
IPT	Integrated Product Team
IQ	In-Phase and Quadrature
IRAM	Institut de Radioastronomie Millimétrique
IRD	Integrated Receiver Digitizer
ISO	International Organization for Standardization
ISP	Internet Service Provider
ITAR	International Traffic in Arms Regulations
JAO	Joint ALMA Observatory
JWST	James Webb Space Telescope
KPP	Key Performance Parameter
KSG	Key Science Goal
L0	Concept, Use Case, and Stakeholder-Level Requirement
L1	System-Level Requirement
L2	Subsystem-Level Requirement
LAST	Local Apparent Sidereal Time
LBA	Long Baseline Array
LBO	Long Baseline Observatory (VLBA)
LFM	Large Facilities Manual
LFO	Large Facilities Office
LIGO	Laser Interferometer Gravitational-Wave Observatory
LISA	Laser Interferometer Space Antenna
LNA	Low Noise Amplifier
LO	Local Oscillator
LOE	Level of Effort
LOI	Letter of Intent
LRU	Line Replaceable Unit
LSP	Legacy Science Program
LSST	Large Synoptic Survey Telescope
LST	Local Sidereal Time
M&C	Monitor and Control
M&S	Materials and Services
MA	Main Array
mas	milli-arcsecond

Acronym	Meaning
MFS	Multi Frequency Synthesis
MMIC	Monolithic Microwave Integrated Circuit
MoE	Measure of Effectiveness
MoP	Measure of Performance
MoS	Measure of Suitability
MPI	Message Passing Interface
MREFC	Major Research Equipment and Facility Construction
MRR	Manufacturing Readiness Review
MS	Measurement Set
MTBF	Mean Time Between Failure
MTDC	Modified Total Direct Costs
MTMFS	Multi-Term Multi-Frequency Synthesis
MTTF	Mean Time to Failure
MTTR	Mean Time to Repair
MVP	Minimum Viable Product
NASA	National Aeronautics and Space Administration
NDA	Non-Disclosure Agreement
NES	Near Earth Sensing
NGAS	Next Generation Archive System
ngVLA	Next Generation Very Large Array
NIO	New Initiatives Office
NIR	Near-Infrared
NRAO	National Radio Astronomy Observatory
NRC	National Research Council of Canada
NS	Neutron Star
NSF	National Science Foundation
NTC	NRAO Technology Center
NTP	Network Time Protocol
OMT	Orthomode Transducer
OODT	Object Oriented Data Technology
OpsCon	Operations Concept
OPT	Observation Preparation Tool
ORR	Operations Readiness Review
OST	Observer Support Tool
OT	Observing Tool
OTFM	On The Fly Mosaic
OWG	Operations Working Group
PA	Product Assurance
PAF	Phased Array Feed
PB	Primary Beam
PBT	Proposal Builder Tool
pc	Parsec
PDR	Preliminary Design Review
PE	Pulsar Engine
PEP	Project Execution Plan

Acronym	Meaning
PHT	Proposal Handling Tool
PI	Principal Investigator
PL	Project Leader
PLL	Phase Locked Loop
PM	Project Management
PMD	Program Management Department
PMP	Project Management Plan
POC	Point of Contact
POP	Program Operating Plan
PPI	Post Processing Interface
PPS	Pulse Per Second
PSD	Power Spectral Density
PSF	Point Spread Function
PST	Proposal Submission Tool
PWV	Precipitable Water Vapor
QA	Quality Assurance
QC	Quality Control
QRFH	Quad Ridge Feed Horn
R&D	Research and Development
RACI	Responsible Accountable Consulted Informed (matrix/chart)
RAOC	Remote Array Operation Center
RD	Reference Document
RefDR	Reference Design Review
REST	Representational State Transfer
RF	Radio Frequency
RFI	Radio Frequency Interference / Request for Information
RFID	Radio Frequency Identification
RFP	Request for Proposal
RFQ	Request for Quotation
RID	Review Item Discrepancy
rms	Root Mean Square
ROM	Rough Order of Magnitude
ROP	Reference Observing Program
RSD	Reference Signal Distribution
RSS	Root of Sum of Squares
RSS	Remote Support Station
RTP	Round Trip Phase
RVTM	Requirements and Verification Traceability Matrix
S/N	Serial Number
SAC	Science Advisory Council
SADC	Serial Analog to Digital Converter
SB	Scheduling Block
SBA	Short Baseline Array
SCT	Source Catalog Tool
SDM	Science Data Model

Acronym	Meaning
SE	Systems Engineering
SEFD	System Equivalent Flux Density
SEMP	Systems Engineering Management Plan
SIS	Semiconductor–Insulator–Semiconductor / Scientific Information Services
SKA	Square Kilometer Array
SMA	Sub-Millimeter Array
SNR	Signal to Noise Ratio
SO	Socorro (NRAO)
SOP	Standard Operating Procedure
SOW	Statement of Work
SPI	Serial Peripheral Interface
SRDP	Science Ready Data Products
SRR	System Requirements Review
SSA	Science Support and Archiving
SSR	Science Support and Research
StRR	Stakeholder Requirements Review
SV	Science Validation
SWG	Science Working Group
SysML	Systems Modeling Language
TAC	Technical Advisory Council / Time Allocation Committee/ Telescope Allocation Committee
TBC	To Be Confirmed
TBD	To Be Determined
TKIP	Travelling-Wave Inductance Parametric
TPM	Technical Performance Measure
TRACE	Technical Risk and Cost Evaluation (Astro2020)
TTO	Technology Transfer Office
UI	User Interface
URSI	Union Radio-Scientifique Internationale
UT	Universal Time
UVa	University of Virginia
UVML	UVa Materials Laboratory
V&V	Verification and Validation
VCC	Very Coarse Channelizer
VFD	Variable Frequency Drive
VLA	(Jansky) Very Large Array
VLASS	Very Large Array Sky Survey
VLBA	Very Long Baseline Array
VLBI	Very Long Baseline Interferometry
VO	Virtual Observatory
WBS	Work Breakdown Structure
WFIRST	Wide Field Infrared Survey Telescope
WVR	Water Vapor Radiometer
XSEDE	Extreme Science and Engineering Discovery Environment

4 Project Lexicon

AAT/PPI Release
Archive Access Tool Post Processing Interface Code base that is validated by an Operations Readiness Review (ORR) and made available for general use.

Agile
Methodology for adaptive development, typically used for software.

Array Maintenance
Monitoring of performance, preventive maintenance, and corrective maintenance of the array by engineers and technicians.

Array Operations
Operations of the array on a day-to-day basis, describing the degree of general automation, the scheduling approach, and operational overheads.

Astro2020
Astronomy and Astrophysics (Astro2020) Decadal Survey that is conducted by the US National Academy of Sciences.

Capability
A set of collective features which provide functionality to a product, defined either in totality or as a subset.

CASA Release
Common Astronomy Software Application Code base that is validated by an ORR and made available for general use.

Delivery
Code that is ready for validation; multiple deliveries constitute a release.

Deployment (Software)
Deployment is the task of releasing code for general use. This typically follows validation to be certain the capabilities function as intended and align with user requirements. Involves updating the release history.

Discovery Driven
A primary mechanism for developing requirements and defining work, typically in an adaptive environment, using rolling wave planning.

Earned Value Management
EVM is a system of programmatic metrics for project performance. Terminology and EVM Processes are defined in the NDIA EVMS Application Guide, which reflects the EIA-748-C-2013 Standard for an EVM System.

Feature
A set of collective stories that work together to realize a functional feature.

Iteration
A designated unit of time, typically sufficient to develop one or more features; requirements are fixed during an iteration.

Key Performance Parameter
KPPs are critical to product performance; each has performance thresholds and objective value.

Measure of Effectiveness
MOEs are developed for each of the L0 Requirements, typically ~6/system.

Measure of Performance
MOPs are derived from MOEs, system performance/capability against system requirements; typically ~5/MOEs are assigned to each L1 requirement.

Measure of Suitability
MOS indicates usefulness, capability, and operability within the given solution.

Metrics
Measures of programmatic processes, requirements compliance and performance. For project performance use terminology and EVM Processes defined in the NDIA EVMS Application Guide, which reflects the EIA-748-C_2013_Standard for EVMS.

Minimum Viable Product
The capability threshold necessary to enter into an ORR.

Plan Driven
A primary mechanism for developing requirements and defining work, typically in a predictive environment, using waterfall planning. Well suited to project management.

Preliminary Baseline
Project primary constraints (scope, schedule, and budget) and secondary constraints (resources, risk, quality), as reflected in the Project Charter, continue under progressive elaboration until changes stabilize and the baseline is relatively mature. Prior to baseline approval, change control does not apply to the preliminary baseline.

Progressive Decomposition
Requirements are progressively decomposed from L0 to L1/L2. They are aligned with the work packages and capability subset to be delivered during a particular planning wave.

Progressive Elaboration
Planning packages are decomposed to work packages in alignment with the level of requirement decomposition provided during a particular planning wave.

Quality
The degree to which a set of inherent characteristics fulfills the identified requirements.

Reference Design
The first technical baseline for the project. The basis of the Astro2020 Decadal Survey cost, risk and technical readiness assessment.

Requirements Backlog (progressive software development)
A requirements backlog is used in an adaptive development methodology where requirement management is flexible, unlike a strict waterfall approach. Requirements are queued in a backlog and prioritized for implementation in the ensuing development/deployment cycle. Frequently, not all requirements can be implemented in the development cycle and lower priority requirements may be carried forward to the next cycle in order to satisfy a fixed release date.

Requirements Fan-Out
As requirements are typically structured in a hierarchy, it can be helpful to establish a consistent fan-out across a system. This can help to ensure that requirements are being defined with the correct level of decomposition, the breakdown is consistent across different subsystems, and similar levels of complexity

are encountered as the integration, verification, and validation processes are executed. A typical ratio is as follows for a system of moderate complexity:

- L0 / MOE 2–12 (~6 per system) these fan out to multiple L1/MOP
- L1 / MOP 2–10 (~5 per L0/MOE) these fan out to multiple L2/TPM
- L2 / TPM 2–6 (~4 per L1/MOP)

Requirements Management and the Tracking Process

- L0 Requirements will be gathered and analyzed for the following:
  - Degree of overlap between science and use cases
  - Science and use cases that have unique and low priority needs
  - Science and use cases that present conflicting needs
- L0 requirements from science and use cases are rank prioritized and weighted.
- MOEs are developed for each of the L0 requirements, typically ~6/system.
- KPPs are identified from the MOEs.
- L0 requirements are assigned to an owner who can validate against the MOE and declare the requirement as met.
- L0 requirements are entered into the RVTM.
- Requirements are analyzed and decomposed from L0 to L1.
- MOPs are derived for each of the MOEs and aligned to the L1 Requirements.
- L1 requirements are assigned to an owner who can verify/validate against the MOP and declare the requirement as met.
- L1 requirements are entered into the RVTM
- For adaptive software development, L1 Requirements are entered into a rank prioritized backlog
- Requirements are analyzed and decomposed from L1 to L2; and associated with architectural elements, sub systems and/or work packages as a function of system complexity.
- L2 requirements are entered into the RVTM

Rolling Wave Strategy

Strategy used to manage the uncertainty of long-term requirements and work package definitions, where these can only be detailed in the short term. Progressive decomposition and elaboration are used to establish planning waves.

Science Ready Data Products (SRDP)

An NRAO project to deliver high-level data products to users, typically calibrated images and image cubes. The capability is provided through a set of releases that span the data processing and delivery system from proposal submission through archive access.

SRDP Release

Code base that is validated by an ORR and made available for general use.

Scientific Operations

The user-facing services provided by the telescope including observation preparation, scheduling, archive access, scientific performance of the array, and the delivered data products.

Specification

In the quality control domain, a stated measurable value with upper and lower control limits.

Specification Document

A set of requirements; can be at any requirement level.

Stakeholder Requirements Specification
A set of stakeholder requirements (L0) gathered into a Specification Document.

Story
The smallest unit of functional code, synonymous with a task.

Subsystem Requirements Specification
A set of subsystem requirements (L2) gathered into a Specification Document.

System Requirements Specification
A set of system requirements (L1) gathered into a Specification Document.

Technical Metrics for Requirements
See MOE, MOP, KPP, TPM.

Technical Specifications
Technical Specifications are derived from the System Requirements, within the functional limits established by the selection of a particular solution.

Updated Baseline
Project primary constraints (scope, schedule, and budget) and secondary constraints (resources, risk, quality), as reflected in the Project Charter, continue under progressive elaboration until changes stabilize and the baseline is relatively mature. Prior to baseline approval, change control does not apply to the preliminary baseline.

Work Backlog
The prioritized rank ordered list of capabilities, features, and stories that are scheduled for completion within a given planning wave, delivery, or iteration.

WBS
The Work Breakdown Structure. Each WBS work package shall have FTE estimates, which are rolled up to a high-level budget estimate. The WBS is traditional and plan driven to capture all project work and break it down to work packages. This is elaborated in the WBS Dictionary, costed, sequenced, and scheduled. This forms the project management baseline, the basis for Earned Value Management (EVM).

WBS Planning Package
The WBS is first established at a high level for planning, before the full extent of detailed work is known. In order to compile a preliminary budget, costs are associated with each package that is defined at this high level. (See WBS Work Package.)

WBS Work Package
The lowest level of the WBS to which resources are assigned, costs monitored, and schedule tracked.