



<b>Project Title:</b> Lexicon and Acronyms	<b>Author:</b> Treacy, Leff	<b>Date:</b> 03/12/2017
<b>NRAO Doc. #:</b>		<b>Version:</b> 01

# **NRAO**

## ***Lexicon and Acronyms***

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**To be maintained as separate documents**

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### Change Record

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## I Abbreviations & Acronyms

AAB	Antenna Assembly Barn (VLA)
AAS	American Astronomical Society
AAT	Archive Access Tool
AD	Assistant Director
ADC	Analog to Digital Converter
AIPS	Astronomical Image Processing Software
AIV	Assembly, Integration, and Verification
ALMA	Atacama Large Millimeter-Submillimeter Array
AOC	Array Operation Center
AUI	Associated Universities Inc.
AWS	Amazon Web Services
BDF	Binary Data Format
BDP	Basic Data Product
CA	Cooperative Agreement
CAP	Contracts and Procurement
CATE	Cost and Technical Evaluation
CASA	Common Astronomy Software Application
CCB	Change Control Board
CDL	Central Development Laboratory
CDR	Critical Design Review
CIS	Computing Information Services
CoDR	Conceptual Design Review
ConOps	Concept of Operations
CSA	Continuing Support Agreement
CSP	Central Signal Processor
CV	Charlottesville Site
ECO	Engineering Change Order
DAC	Digital to Analog Converter
DBE	Digital Backend
DC	Direct Costs
DMS	Data Management and Software
DO	Director's Office
DSP	Digital Signal Processor
DTS	Digital Transmission System
EDMS	Electronic Document Management System
EMC	Electro-Magnetic Compatibility



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- EMI Electro-Magnetic Interference
- EOC Extension and Optimization of Capabilities
- EPO Education and Public Outreach
- ESS Environmental Safety and Security
- ETK Electronic Time Keeping
- EVM Earned Value Management
- FIT Failures in Time
- FITS Flexible Image Transport System
- FMECA Failure Modes Effects and Criticality Analysis
- FTE Full Time Equivalent
- GBO Green Bank Observatory
- HPC High Performance Computing
- HR Human Resources
- ICC Internal Common Costs
- ICD Interface Control Document
- IDC Indirect Costs
- IF Intermediate Frequency
- IMS Integrated Master Schedule
- IPC Institute for Packaging electronic Components
- IPT Integrated Product Team
- ISO International Organization for Standards
- ITAR International Traffic in Arms Regulations
- JAO Joint ALMA Observatory
- KPP Key Performance Parameter
- L0 Concept, Use Case, and Stakeholder Level Requirement
- L1 System Level Requirement
- L2 Subsystem Level Requirement
- LAST Local Apparent Sidereal Time
- LBO Long Baseline Observatory
- LFM Large Facilities Manual
- LFO Large Facilities Office
- LNA Low Noise Amplifier
- LO Local Oscillator
- LOE Level of Effort
- LOI Letter of Intent
- LRU Line Replaceable Unit
- LSP Legacy Science Program
- LST Local Sidereal Time



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- M&C Monitor & Control
- M&S Material and Services
- MFS Multi Frequency Synthesis
- MMIC Monolithic Microwave Integrated Circuit
- MOE Measure of Effectiveness
- MOP Measure of Performance
- MOS Measure of Suitability
- 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 MFS
- MTTF Mean Time To Failure
- MTTR Mean Time To Repair
- MVP Minimum Viable Product
- NGAS Next Generation Archive System
- NIO New Initiatives Office
- NRAO National Radio Astronomy Observatory
- NRC National Research Council of Canada
- NSF National Science Foundation
- NTC NRAO Technology Center
- 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
- OWG Operations Working Group
- PAF Phased Array Feed
- PB Primary Beam
- PDR Preliminary Design Review
- PEP Project Execution Plan
- PI Principal Investigator
- PL Project Leader
- PMD Program Management Department
- PMP Project Management Plan



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- POC Point of Contact
- POP Program Operating Plan
- PPI Post Processing Interface
- PSF Point Spread Function
- PST Proposal Submission Tool
- QA Quality Assurance
- QC Quality Control
- R&D Research and Development
- RACI Responsible Accountable Consulted Informed (matrix/chart)
- RAOC Remote Array Operation Center
- RefDR Reference Design Review
- RF Radio Frequency
- RFI Radio Frequency Interference
- RFI Request for Information
- RFP Request for Proposal
- RFQ Request for Quotation
- RID Review Item Discrepancy
- ROM Rough Order of Magnitude
- RTP Round Trip Phase
- RVTM Requirements and Verification Traceability Matrix
- SAC Science Advisory Council
- SADC Serial ADC
- SB Scheduling Blocks
- SBA Short Baseline Array
- SCT Source Catalog Tool
- SDM Science Data Model
- SEMP Systems Engineering Management Plan
- SIS Scientific Information Services
- SIS Semiconductor–Insulator–Semiconductor
- SO Socorro Site
- SOP Standard Operating Procedure
- SOS Small Operations Center
- SOW Statement of Work
- SRDP Science Ready Data Products
- SRR System Requirements Review
- SSA Science Support & Archiving
- SSR Science Support & Research
- StRR Stakeholder Requirements Review



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- TAC Technical Advisory Council
- TKIP Travelling-Wave Inductance Parametric
- TPM Technical Performance Measure
- TTO Technology Transfer Office
- URSI Union Radio-Scientifique Internationale
- UVa University of Virginia
- UVML UVa Materials Laboratory
- VLA Very Large Array
- VLASS VLA Sky Survey
- VLBA Very Long Baseline Array
- VLBI Very-Long-Baseline Interferometry
- VO Virtual Observatory
- WBS Work Breakdown Structure
- WFO Work for Others
- XSEDE Extreme Science and Engineering Discovery Environment

## 2 Lexicon

### AAT/PPI Release

Archive Access Tool Post Processing Interface Code base that is validated by an ORR and made available for general use

### Agile

Methodology for adaptive development, typically used for software

### Array Maintenance

Monitoring of performance, preventive maintenance, and reactive 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.





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Capability

A set of collective features which provide functionality to a product, either defined 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)

EVM is a system of programmatic metrics against 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

SRDP Execution Phase

The SRDP Project lifecycle is defined in three phases;\_Initiation, Execution, and Transition. The Execution Phase begins with successful completion of CoDR with all open items resolved. The Execution Phase ends when project metrics can inform project leadership that the progressive software deliveries have met project objectives and SRDP processes have matured to a point where SRDP processes are sufficiently routine operations are able to sustain further release cycles.

Feature

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

Grooming the Backlog

Re-evaluation and prioritization of the requirements backlog at regular intervals, prior to the start of



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new work where requirements are then fixed for the duration of the work period

#### Iteration

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

#### Key Performance Parameter

KPP – Critical to product performance, each has performance thresholds and objective value

#### Measure Of Effectiveness

MOEs are developed for each of the LO Requirements, typically ~ 6/system

#### Measure Of Performance

MOP – derived from MOE, system performance/capability against system requirements, typically ~ 5/MOE assigned to each L1 requirement

#### Measure Of Suitability

MOS - usefulness, capability, and operability within the given solution  
Technical Performance Measure TPM - - measure of system elements

#### Metrics

Metrics can be defined for a number of purposes. Metrics against programmatic processes, requirements, and typically found in use at NRAO. defined for SRDP, 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

#### Planning Horizon

The forward boundary in a planning wave where scope

#### Preliminary Baseline

Project primary constraints (scope, schedule, and budget) and secondary constraints (resources, risk,



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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 and 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

SRDP defines Quality as a measure in three areas;

Project Quality Management

#### 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 the 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 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



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- 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

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

#### Science Ready Data Products

Metrics on failure rates of overall data traffic, weather, equipment, RFI, etc.

Metrics on Published uses, referenced images, etc.

#### 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 is a stated measurable value with upper and lower control limits

#### Specification Document

A set of requirements, can be at any requirement level

#### SRDP Release

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

#### SRDP Roadmap

The full set delivered SRDP capability, partitioned in subsets for the development phase under which each subset will be delivered

#### Stakeholder Requirements Specification

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

#### Sub-System Requirements Specification



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A set of Sub-system requirements (L2) gathered into a Specification Document

#### System Requirements Specification

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

#### Story

The smallest unit of functional code, synonymous with a task

#### 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 WBS should drive the requirements

Each WBS work package shall have FTE estimates, which are rolled up to a high-level budget estimate

Traditional – Plan Driven - to capture all the project work and break it down to work packages, elaborated in the WBS Dictionary, costed, sequenced, and scheduled. This forms the PMB, the basis for 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)



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### WBS Work Package

I found the following typical fan out for metrics, the same fan out applies to Requirement levels.

### 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)



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## Appendix