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MWA Project

Test and Evaluation Management Plan (TEMP)

MWA Project

MWA Consortium

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Table of Contents

List of Figures

List of Tables

1. INTRODUCTION

1.1 IDENTIFICATION

The Test and Evaluation Management Plan (TEMP) identifies the plans, processes and approaches that will be used by the MWA Project during the test and evaluation sub-programme of the project.

This plan is subordinate to the Systems Engineering Management Plan (SEMP) [6].

The TEMP will be subject to configuration control and form part of the project baseline. Accordingly, the TEMP shall require approval by the MWA board.

1.2 SCOPE

This document describes the plan for managing, performing, and monitoring the system testing activities for the MWA Telescope Project. Included in this plan are:

- references used as the basis for test management, planning, development and documentation;
- the group(s) responsible for planning, management and test execution;
- an overview of the testing at the various phases of instrument delivery and implementation including processes for evaluating test adequacy;
- test facility, test equipment and testing support requirements;
- the approach for documenting, tracking and resolving issues found during testing;
- reporting of test results; and
- the plan for developing acceptance criteria.

This TEMP is an Engineering Management level document and applicable to the project lifecycle. It focuses on the overall approach to testing to ensure that the final system meets the relevant acceptance criteria.

Properly managed testing will be crucial both to deliver preliminary results from the demonstrator and assure convergent development on the path from demonstrator to the production system. Furthermore, testing will ensure continuous system performance in light of maintenance actions during the usable life of the instrument.

Testing in the 32-T demonstrator phase will be primarily guided by existing commitments to demonstrate somewhat limited functionality to project Sponsors (cf. ref. [4]), however this will lead to capture of System Requirements for the production instrument, and in turn, will lead to formal testing against those requirements.

1.3 DOCUMENT OVERVIEW

This document is structured as follows:

- Section 1 Introduction
- Section 2 Referenced Documents

- Section 3 ...

TBD

2. REFERENCED DOCUMENTS

2.1 STANDARDS

[1] DoD standard 5000.2-R, Test and Evaluation Master Plan (TEMP), April 2002.

[2] IEEE Std 829-1998, Standard for Software Test Documentation.

[3] MIL-STD-461F, Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment. Dec 2007.

2.2 MWA DOCUMENTS

[4] MWA 32-T Criteria Rev 1.0-2 arw edit.pdf, MWA 32-T Objectives and Quality Assurance Evaluation Criteria, Sept-2009.

[5] MWA-XXX-XXX - MWA Project, Project Management Plan (PMP), 18-Oct-2009.

[6] MWA-XXX-XXX - MWA Project, Systems Engineering Management Plan (SEMP), 18-Oct-2009.

[7] MWA-XXX-XXX - MWA Project, Configuration Management Plan (CMP), 18-Oct-2009, Rev 0003.

2.3 OTHER DOCUMENTS

[8] Standards for Equipment to be deployed on the MRO v0.4, CSIRO, Aug-2008.

[9] NARA ERA Testing Management Plan (TSP), May 2003.

3. ACRONYMS AND DEFINITIONS

The following list of acronyms, abbreviations and definitions are used within this document.

3.1 ACRONYMS AND ABBREVIATIONS

Table 1 contains the acronyms and abbreviations used within this document.

Table 1 Acronyms and Abbreviations

Term	Meaning
ATNF	Australia Telescope National Facility
CCB	Change Control Board
CI	Configuration Item
CIRA	Curtin Institute of Radio Astronomy
CMP	Configuration Management Plan
CR	Change Request
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DT	Development Testing
ICD	Interface Control Document
KPP	Key Performance Parameters
MRO	Murchison Radio-astronomy Observatory
PAT	Production Acceptance Test
PMO	Project Management Office
PMP	Project Management Plan
QA	Quality Assurance
QC	Quality Control
QM	Quality Management
RD	Requirements Document
SAT	Site Acceptance Test
SME	Subject Matter Expert
T&E	Test and Evaluation
TEMP	Test and Evaluation Management Plan
TIR	Test Incident Report
TRR	Test Readiness Review
UT	Unit Testing
UUT	Unit Under Test

3.2 DEFINITIONS

Table 2 contains definitions of terms that are used within this document.

Table 2 Definitions

Term	Description
Acceptance Criteria	The set of criteria that must be satisfied in order that an item (component, sub-system, system) be acceptable to a user, customer or other appropriate entity.
Acceptance Testing (AT)	Formal testing conducted to establish whether a *system* meets pre-agreed *acceptance criteria* and allows the *customer* to decide whether to accept the system (see also *Site Acceptance Testing*)
Bugzilla	An open source bug reporting and tracking tool.
CIRA	Curtin Institute of Radio Astronomy, part of Curtin University, Western Australia, and the geographically closest MWA Collaboration Partner to the MRO.
Component	A functional sub-set of a *system* being tested, see also *UUT*.
Configuration Item (CI)	A set of hardware and/or software that is designated for Configuration Management and treated as a single entity for that purpose.
CSIRO ATNF	The owner/overseer of the Murchison Radio-astronomy Observatory site, and the entity mandating RFI compliance via refs. [3] & [8]
Customer	The intended user, or user community, for whom the *system* has been designed. The entity which will accept the *system* that passes *acceptance testing.*
Developer	The entity manufacturing hardware, or designing software or firmware, for the MWA Project.
Development Testing (DT)	Formal and / or informal testing conducted during the development of a sub-system or component, usually conducted in the development environment, by the developer.
Environmental Testing	Testing a UUT to ensure that it operates correctly in the environmental conditions for which it is designed.
Functional Testing	Testing that ignores the internal workings of the UUT, and focuses solely on outputs generated in response to selected stimuli. (cf. *Structural Testing)*
Independent Verification and Validation (IV&V)	Verification and validation performed by an entity that is materially independent from the development organisation.
Integration Testing	Testing in which items which have been previously *unit tested* (qv.) are interconnected in the manner they will be used in the *system*, and the interaction between the items is tested. This may occur more than once and in more than one location, prior to final acceptance testing.
Murchison Radio-astronomy Observatory	The MRO in the Mid-West of Western Australia is the current site for the 32-Tile MWA demonstrator, and the proposed site for the 512-Tile MWA production telescope. This is where SAT will be conducted.
Operational Testing	Testing a *system* in its normal operating environment (see also *Site Testing*)

Table 2 Definitions	
Term	**Description**
Pass/Fail Criteria	Rules used to determine whether the UUT passes or fails a given test.
Performance Testing	Testing conducted to assess the compliance of a UUT against specific performance requirements.
Practical Completion	The point at which the Instrument has successfully undergone in-field verification testing thereby commencing the System Commissioning and Early Science phase of the project.
Production Acceptance Testing	Acceptance Testing conducted on a component or sub-system at the production facility prior to delivery to either an intermediate location for Integration testing, or direct to site for Site Acceptance Testing.
Quality Assurance (QA)	The ongoing evaluation of an overall project to maintain confidence that the system will satisfy relevant quality standards.
Quality Control (QC)	The process of monitoring specific project results to ensure they comply with quality standards, and managing unsatisfactory performance.
Quality Management (QM)	The processes needed to ensure the project satisfies the needs it is designed to address.
Regression Testing	Selective re-testing of a UUT to ensure that modifications have not caused unintended impacts (“side effects”) and that the UUT still complies with requirements.
Site Acceptance Testing	Acceptance Testing on a system when it is installed in its final operating site location, usually conducted in the presence of witnesses approved by the customer.
Stress Testing	Testing a UUT at or beyond the limits of normal operational requirements.
Structural Testing	Testing that takes into account the internal architecture of a UUT (cf. *Functional Testing*)
System	The entire integrated collection of hardware and software components (that is, all the Configuration Items) that form the deliverable product to the *customer*.
Test	A formal process where a UUT is subjected to a specified set of conditions, the results are observed and recorded, and an evaluation or analysis is made of those results.
Test Case Specification	A document describing a particular set of conditions, inputs, and the expected outputs for a UUT. Part of a *Test Procedure* (qv.)
Test Incident Report (TIR)	A report detailing any event arising during testing that requires further investigation, and conditions required to replicate the event.
Test Log	A chronological history of relevant details during execution of a test procedure.
Test Plan	A document outlining the scope, approach, resources and schedule of intended testing activities. It identifies test items, parameters to be tested, who will perform the tests and where, any limitations on the test conditions, and the reporting requirements.

Table 2 Definitions	
Term	**Description**
Test Procedure	Detailed instructions for the set-up and execution of a test case or sequence of test cases, and the process for evaluating the results.
Test Readiness Review (TRR)	A review conducted prior to a formal test for a given UUT. The review ensures that the test procedures are complete and comply with the test plan, and that testing will demonstrate compliance with system requirements. This review verifies that a project is ready to proceed to formal testing.
Test Summary Report	A document summarising the activities and results of testing. It includes and evaluation of the results against the pass / fail criteria.
Testability	The degree to which a system requirement is specified in terms that facilitate: the establishment of test criteria, and the ease of designing tests to evaluate the system against those criteria.
Testing	The process of exercising a system to expose any differences between actual performance and the performance expected to meet system requirements (“bugs”).
Unit Testing	The testing of individual UUTs, prior to Integration and Site Acceptance Testing.
Unit Under Test (UUT)	The component, sub-system or entire system which is being subjected to a particular test or tests. This could be either hardware or software items, or both.

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4. BRIEF PROJECT DESCRIPTION

The MWA Project has a wide geographical and institutional spread as well as involvement with several industry partners. Furthermore the final destination for both the 32-Tile and 512-Tile instruments is the MRO, which is approximately 800km away from the nearest collaboration partner, and across the world from the furthest.

In terms of the physical equipment, the 32-Tile MWA demonstrator telescope consists of:

- off-the-shelf computing, network and other digital system elements purchased by the collaboration;
- contract manufactured electronic hardware produced by the industry partners; and
- one-off assembled prototype electronics units supplied by MWA collaboration partners “at-cost” to the project (only for the 32-Tile demonstrator).

Operating system software on the computing elements is Linux-based, and all software and firmware to date has been developed by MWA collaboration partners.

For the 512-tile system, it is anticipated that *all* hardware equipment will be purchased off the shelf or manufactured by MWA Industry Partners under more traditional supply contracts.

Therefore the MWA TEMP needs to have a varied approach to ensure success of the 32-tile demonstrator, and then measure and control the development towards the final-built Instrument against its requirements.

In both phases, and regardless of whether a given Configuration Item is hardware, software, purchased or developed in-house, testing must still be applied to it, initially to ensure fitness for purpose, then again on installation on site, and finally through all operational phases of the Instrument through to end-of-life.

In developing the 512-Tile telescope, some items will move directly from the manufacturer to the final installation site, while other items will be Integration-tested at CIRA. Testing must be conducted in such a manner that minimises the risk that a failure can cause unnecessary shipping of items.

The design and implementation of this Test and Evaluation Management Plan will be reviewed and approved by both the MWA Board, and the Project Sponsors who will approve the requirements and acceptance criteria and act in the role of Customer for the MWA project.

5. TESTING MANAGEMENT STRUCTURE

Given the large number of sources for Configuration Items, both hardware and software, there is a requirement for several Test Engineers or Teams. There must be at least one Test Engineer or Team for each location where a hardware sub-system or component will be subject to Production Acceptance Testing (PAT) prior to delivery for Integration testing and / or subsequent Site Acceptance Testing. There must also be people acting in the role of Test Engineer (or Team) at each location where software is being developed.

The MWA Test organisation structure that will manage and support these various groups of Test Engineers (or Teams) as shown diagrammatically below.

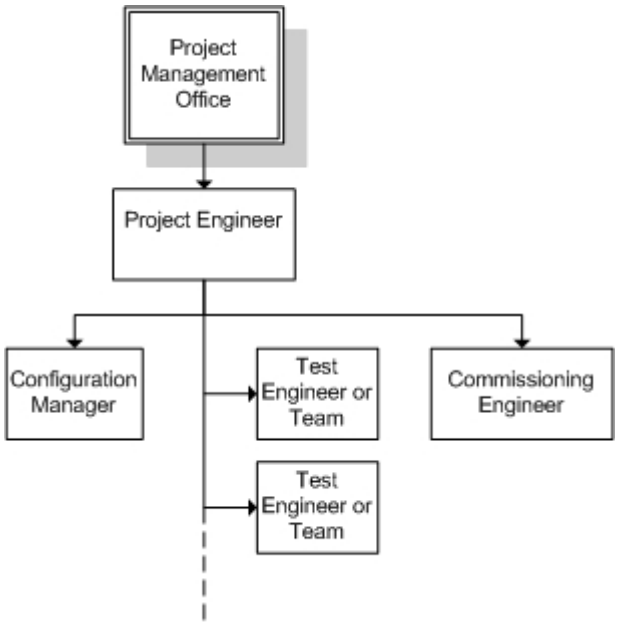

Figure 1 MWA Test Organisational Chart

Various Subject Matter Experts may be called upon by the MWA PMO from time to time, to assist in the management or design of Testing and Evaluation to help ensure adequate testability of system requirements and assess the validity of testing.

Independent Verification will be required to confirm compliance with CSIRO's Radio Frequency Interference (RFI) requirements which will form part of the System Requirements for any instrument designed to operate in the MRO (cf. refs.[3] and [8]).

5.1 ROLES AND RESPONSIBILITIES

Table 3 Test Organisation Roles and Responsibilities	
Role	**Required Responsibilities**
PMO	• Manage the design and implementation of the TEMP. • Liaise with Board, Project Sponsors and any external agencies. • Liaise with, and report to CSIRO regarding RFI Compliance. • Ensure adequate testing facilities at each test location. • Ensure testability of system requirements. • Define testing organisation and identify responsibilities. • Oversee Quality Assurance and enact Quality Control. • Determine the schedule for TRRs.
Project Engineer	• Oversee the detailed design of Test Plans and Test Procedures. • Periodically review test results to ensure requirements satisfaction.
Configuration Manager	• Ensure correct hardware environment and software builds prior to testing. • Oversee configuration changes resulting from bug fixes to ensure compliance with the CMP.
Commissioning Engineer	• Assist the Project Engineer with his/her responsibilities. • Monitor test work products and results. • Lead TRRs. • Develop and refine Site Acceptance Test. • Ensure problem reporting and tracking of issues until closure. • Collect, archive and distribute test documentation • Manage the problem reporting database.
Test Engineers	• Assist in analysing System Requirements and developing Test Plans and Procedures. • Create test tools / jigs, ensure test environment. • Develop and conduct Test Plans, Test Procedures, scripts scenarios and tools, and document tests results and report. • Assist CE in developing Site Acceptance Test. • Participate in Test Readiness Reviews (TRRs).

5.2 INCREMENTAL APPROACH

As indicated above, the MWA telescope will be delivered in at least two phases, those being a 32-Tile demonstrator and a 512-Tile production system. The Test organisation will use an incremental approach to Testing and Evaluation which will ensure a usable, operational system at the completion of each phase.

Also, the results of testing at the 32-tile demonstration phase will assist with the formal engineering approach to designing the 512-tile production system.

Finally, consistently designed Testing and Evaluation will allow for proper Regression Testing as maintenance occurs on the operational 512-tile production system on-site, as well as in light of future additions, expansions or improvements that may be proposed during the useful instrument lifetime.

5.3 STATUS REPORTS

Testing activities will be reported on a regular basis throughout all phases of development, operation and instrument life. Each Test Engineer or Team at each location will provide activity and status reports to the MWA PMO who will publish those test results within the MWA collaboration group for the benefit of any groups affected by test outcomes.

The frequency and procedure for delivering these reports will be decided by the MWA PMO and may be varied from time to time during the instrument life cycle. These decisions will be conveyed to the MWA Test organisation via the Project Engineer.

5.4 MANAGEMENT AND QA REVIEWS

All testing activities will be reviewed by the MWA PMO, as it sees fit, to ensure satisfactory project performance. Also, the testing process will be subject to Quality Management audits and reviews.

5.5 TEST READINESS REVIEWS (TRRS)

There are three major goals of TRRs. Firstly, TRRs ensure that all related test items, materials and documentation have been completed and are ready to hand over to the next testing phase. They also provide assurance to management that UUTs have undergone thorough testing. Finally, TRRs minimise the risk that testing has to be aborted and re-started due to inadequate preparation or other preventable circumstances.

The MWA PMO will determine the various project milestones at which TRRs will be conducted. The format, location and required attendance will also be determined for each review. Finally the MWA PMO will specify the successful exit criteria which must be met before the tests can be commenced.

6. TESTING AND EVALUATION

For hardware Configuration Items, MWA Test and Evaluation (T&E) involves a sequence of three levels of testing, Unit Test during development, Production Acceptance Testing before shipment, and Site Acceptance Testing as part of final Acceptance Test. Software CIs will be subject to Unit and Integration Testing, before final Acceptance Test on site.

T&E will be structured to:

- provide inputs to decision making;
- gain essential information for assessing technical risk;
- determine the performance parameters of the system architecture and design;
- verify attainment of performance objectives to meet requirements; and
- confirm that the Instrument is operational and suitable for its intended use.

The MWA Test organisation will monitor all aspects of testing for compliance with this plan and to ensure adequacy of testing.

Design leading up to the 32-tile phase is best described as “exploratory” or “research” prototyping and has not generally adhered to engineering best-practices. Therefore testing at this 32-tile phase will be aimed at demonstrating compliance with the acceptance criteria previously agreed with the Project Sponsors.

The 512-tile instrument will follow the usual “waterfall” model, and so testing during this second stage will adhere to Project Management best-practices, and be oriented towards demonstrating that the system is engineered to meet System Requirements and therefore passes Site Acceptance Testing. During this phase, testing will be iterative to ensure development progresses towards goals that are set at the beginning of the 512-tile phase.

The diagram below relates the various levels of testing to stages in the design process for the 512-tile instrument.

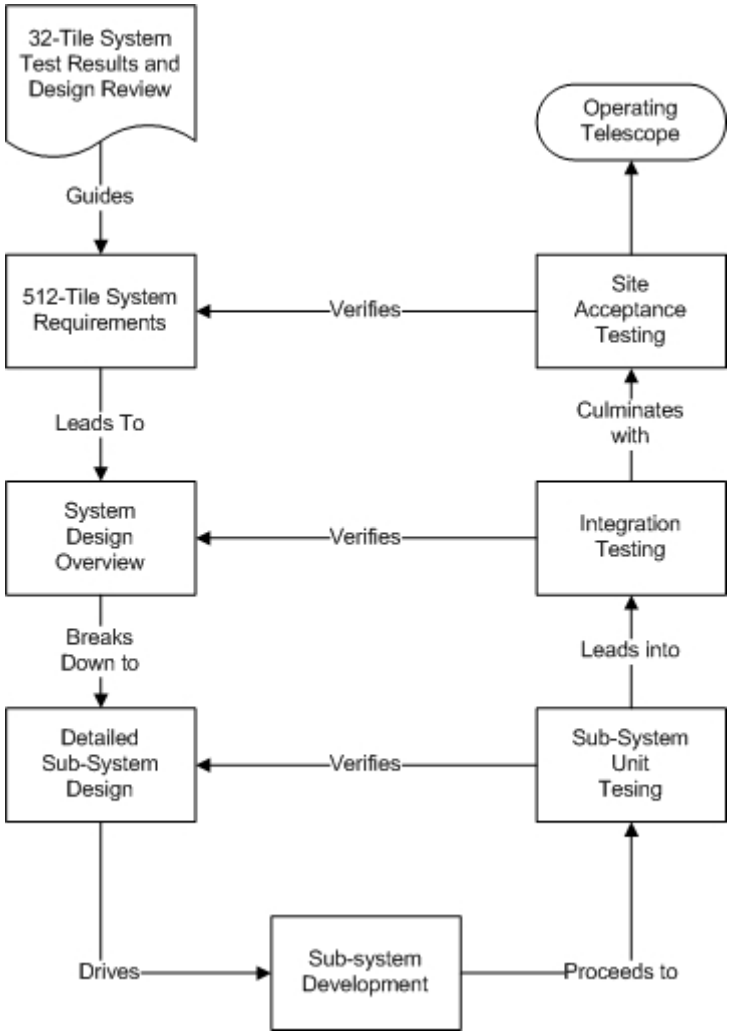

Figure 2 Testing Phase Relationship to Development

In the 512-T phase, reviews and audits of testing during development will be used to monitor technical and schedule risk, support TRRs and subsequently support Site Acceptance Testing. The Site Acceptance Test will collect data that will demonstrate that the Instrument meets the Key Performance Parameters derived from System Requirements.

The MWA PMO will establish the necessary discipline, rigour and structure to achieve the objectives of T&E by implementing and managing the testing strategy, assigning resources, witnessing certain testing and monitoring results.

6.1 DEVELOPMENT TESTING OVERVIEW

The objectives of Development Testing (DT) are to verify the status of CIs during development, verify that design risks have been minimised, demonstrate that all KPPs specified in the RD have been met, and certify readiness for PAT and/or SAT. Development testing is iterative in nature and includes Unit Testing and Integration Testing.

6.1.1 Unit Testing

Unit Testing (UT) is the basic level of testing that focuses on individual building blocks of the system separately. It is applicable both to hardware and software CIs. UT is the earliest phase of testing and is the most cost-effective phase of development where defects can be detected and corrected. It also promotes easier integration and testing of sub-systems during the build-up phase towards site deployment and final Site Acceptance Testing.

To conduct Unit Testing, the detailed unit design is used as a basis to compare how and what the unit is able to perform. The developer will be responsible for not only conducting the Unit Testing but also presenting the results and reports to the MWA PMO for monitoring purposes.

Unit testing is generally a combination of Structural and Functional testing, examining both the inputs and outputs of the UUT, as well as the internal structure.

6.1.2 Integration Testing

Where feasible, Integration Testing will follow on from Unit Testing and occur prior to PAT or SAT. Again, Integration Testing applies both to hardware and software CIs. Items subject to Integration Testing will be systematically added to a core of previously integrated and tested items, and the resulting new partial configuration will be subject to Integration Testing. The goals here are to verify that units interoperate correctly and conform to their associated Interface Control Documents. Integration Testing is generally Functional in nature, the internal structure having been tested as part of Unit Testing.

Given the distributed nature of the MWA Project, a software CI may well have been written, Unit Tested and even passed PAT on quite a different computer system from the one on which it will eventually run in the field. Therefore the act of re-testing that software CI on the actual intended hardware (even before it reaches the final site) may be considered as Integration Testing.

Integration Testing also supports the Quality Management by providing data indicating that as the system is progressively integrated it continues to meet the KPPs derived from the System Requirements.

Integration testing will typically be done with the direct involvement of the Project Engineer or Commissioning Engineer and the results and reports presented to the MWA PMO.

6.2 DEVELOPMENT TEST ENTRANCE AND EXIT CRITERIA

The DT entry criteria are:

- System Requirements have been flowed down through Systems Engineering process.
- Test Plans have been drawn up, leading to test procedures, and all plans and procedures have been approved by the MWA Test organisation.

Exit criteria which must be met to successfully complete DT are:

- All test documentation approved
- All tests have been executed and Test Incident Reports generated for each failure or anomaly
- All issues identified in TIRs have been resolved.
- All changes to Configuration Items resulting from TIRs have been managed in accordance with the Configuration Management Plan, and specifically, that Engineering Documentation has been updated to reflect the changes.
- Regression Testing has confirmed that changes have successfully rectified any failures or anomalies and not compromised other aspects of the system operation.
- The testing reports have been reviewed and approved by the MWA Test organisation.

6.3 ACCEPTANCE TEST OVERVIEWS

With respect to procurement, Acceptance Testing (AT) forms contractual decision points where sub-systems and documentation are accepted by the MWA Project as being suitable to meet the requirements set out in development contracts let to suppliers. Acceptance Testing is functional in nature, and consists of Production Acceptance Testing at the manufacturer's facilities, followed by on-site Integration Testing and final Site Acceptance Testing. This may also include Configuration Management and Quality Management auditing. Auditing of this nature will confirm, for each configuration item, that the configuration identification is accurate, complete and meets specified requirements.

The objectives during SAT are to demonstrate that the Instrument is operational and suitable for its intended use, is supplied with accurate user documentation and meets the KPPs derived from System Requirements. SAT also confirms that any training packages intended for the Operations group are correct and useful.

AT results shall form the basis of the MWA PMO's recommendation to the Project Director, hence the MWA Board and project Sponsors regarding final acceptance of the deployed instrument.

6.3.1 Production Acceptance Tests

TRRs will be conducted prior to Production Acceptance Tests. The primary outcome of the PAT will be to assure that the UUT being accepted is functionally robust and any documentation being supplied is correct and has been tested against the product for technical accuracy. Further, PAT ensures the UUT will sustain the required level of performance as documented in the RD, under normal operating conditions.

PAT will be conducted at the developer's manufacturing facility before delivery of the hardware CIs to either CIRA or the MRO site. The first time PAT is conducted at the developer's location, MWA PMO will determine a suitable member of the MWA Test organisation to inspect the facility and witness the testing for audit purposes. The MWA PMO will determine the required level of continued supervision of PAT by the project on a case-by-case basis.

6.3.2 Site Acceptance Test

SAT will be conducted at the Murchison Radio-astronomy Observatory (MRO) site where the instrument will be commissioned. More than one SAT can take place, as significant aspects of the system are integrated onto site and tested in place.

The primary goal of the final SAT will be the demonstration that the MWA 512-tile Instrument is complete and has reached the point of Practical Completion.

6.4 ACCEPTANCE TEST ENTRANCE AND EXIT CRITERIA

Entry criteria for the AT include successful completion of development testing and Configuration Management control of documentation, software and hardware.

Upon completion of the AT, an Acceptance Test Report (ATR) will be prepared and submitted for review and approval, as appropriate.

7. TEST REPORTING

Issues uncovered during testing, and the overall results of Testing, will be documented in one of two types of report as described in the following sections.

7.1 PROBLEM REPORTS

Problem Reports will be tracked using the MWA issues tracking system, nominally Bugzilla tool.

Problem reports will be used to document anomalies, deficiencies or discrepancies between expected and actual behaviour, whether testing runs to completion, or ceases due to the issue that has arisen. Ideally, the report should describe an initial analysis of the problem, and how to reproduce it. The primary purpose of this report is to allow the developer(s) to rectify the problem.

Minimally, a problem report will contain:

- Name of Test Engineer or Team executing.
- Name of the Test Plan and Test Procedure documents describing the test.
- Problem report number (unique ID assigned in the Issue Tracking system).
- Severity of the problem.
- Summary description of the problem.
- Steps required to reproduce the problem.
- Region within the system or UUT where problem occurred.
- Any other relevant information.

Note that a test which fails to be successfully completed due to reasons other than a problem with the UUT (eg. failure of a piece of test equipment, power failure, etc.) does not necessarily constitute an Issue. Notes should be made in the Test Report, however, if this occurs, regardless of whether the test is continued, restarted or aborted.

Problem reports will be submitted electronically to Bugzilla, and will be directed to the attention of development team leader. Where a problem stems from a design deficiency in the UUT, the Project Engineer will bring it to the attention of the MWA PMO for further analysis, where a decision may be made to alter the system requirements (RD), direct the development team to re-design the UUT, or take some other suitable action.

When a problem is rectified, the UUT is then re-tested (Regression Testing) and on successful execution of the test(s) the problem is marked “closed” in the MWA Issue tracking system, and a test report is completed for that UUT.

7.2 TEST REPORTS

Test reports will be used to document the overall results of a test and will recommend a course of action based on these results. Reports will be written for each phase of DT and AT. The report describes the testing being done and

enumerates and evaluates the results. Test Reports will be stored in the Project Database (cf. CMP [7]).

The Test Report will consist of:

- Test Report ID (unique number assigned from Project Database)
- Name of Test Engineer or Team executing tests
- Summary of Tests (refer to Test Plan and Procedures)
- Comprehensiveness Assessment
- Summary of Test environment, activities and results
- List of variances from expected outputs/performance
- Evaluation of results (eg. impact of variances).
- Recommended course of action (eg. accept as fit for use, send for repair, re-engineer, etc.).
- Approvals (names of persons required to approve the report).

Completed Test Reports will be submitted to the Project Engineer who will review them and release them for recording in the Project Database. The Project Engineer will also assess the recommendations and instigate any further actions, if required.

When requested by the MWA PMO, the Project Engineer will present summaries of Test Reports for consideration by the Project.

8. INDEPENDENT VERIFICATION

The MWA PMO may be required to engage Independent testing organisation(s) where the Project requires testing to be done against to Certified Test Standards or where specialist equipment or expertise are necessary (for example MIL-STD-461F for the control of electromagnetic interference).

In these cases, the PMO will liaise with the external agency requiring compliance (eg. CSIRO) and the Independent organisation(s) to ensure the required materials are supplied to the group for testing and the ensuing reports are delivered to and accepted by the agency requiring compliance.

Independent Verification by review may also be required from time to time, to assess whether major project units are being developed in such a way that they will meet System Requirements. The MWA PMO will be the body responsible for deciding when such reviews are required and then selecting and engaging an external review body. The MWA PMO will then receive the results of that review and act on them accordingly.

9. TEST AND EVALUATION RESOURCE SUMMARY

This section describes overall T&E resources that will be used during the course of the MWA Project.

9.1 TEST ITEMS

All testable items that comprise either the 32-tile or 512-tile Instrument will be tested during development and at acceptance. Items already on-site will be re-tested as part of regression testing, integration testing or both and again as part of Site Acceptance Testing.

9.2 TEST ENVIRONMENTS AND FACILITIES

On an on-going basis, the MWA PMO will assess and/or establish suitable test environments and facilities at the required locations and ensure sufficient time is allowed for set-up and maintenance of such facilities and environments. Special facilities (e.g. environmental chambers) may be required that are beyond the resources of the Project and may have to be contracted in as required. The MWA PMO will be responsible for sourcing and contracting such resources.

9.3 TEST SUPPORT EQUIPMENT AND JIGS

The MWA PMO will request all development groups and industry partners to specify any special test equipment and/or jigs required for testing and will be responsible for acquiring such equipment in a suitable manner (e.g. purchasing, leasing etc.). Any purchased test equipment and / or manufactured test jigs may be subjected to suitable Acceptance Testing before being deemed fit to support the MWA Test organisation.

9.4 STAFFING AND PERSONNEL TRAINING

The MWA PMO will be responsible for approving all staff or contractors who will be conducting testing, and will ensure that those people are adequately trained and knowledgeable to conduct the tests. In the case of development testing, the MWA PMO may delegate that responsibility as it sees fit, to development team leads, or otherwise.

10. RISKS AND CONTINGENCIES

A system the size and nature of the MWA Instrument, and which is installed at a remote site such as the MRO, will not be void of risks to personnel and equipment, and will require the associated mitigations if it is to succeed.

A solid test management strategy backed up with CM, QM and the associated reviews and reporting methods, will prove beneficial to the MWA Test organisation and may help lessen risks. Such risks will be managed in accordance with the Risk Management Plan, a subsection of the PMP.

11. PLAN MAINTENANCE

The Commissioning Engineer is responsible for this plan (TEMP). It is anticipated that as part of ongoing process improvement (including external reviews, lessons learned and QM audits) testing processes will change and improve as testing matures.