

# MINISTRY OF DEFENCE



## MOD Architecture Framework Tool Certification Plan

Version 1.0

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Approved by:- MODAF Technical Working Group

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## RECORD OF CHANGES

This page will be updated and re-issued with each amendment. It provides an authorisation for the amendment and a checklist to the current amendment number.

| <b>Issue No.</b> | <b>Date</b>      | <b>Revision Details</b>                      |
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| Draft 0.2        | 2 March 2006     | Risks and assumptions added                  |
| Draft 0.3        | 8 March 2006     | Issue for stakeholder review                 |
| Draft 0.4        | 30 March 2006    | Incorporation of stakeholder review comments |
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## Table of Contents

|   |    |
|---|----|
| Table of Contents.....  | 3  |
| 1 Introduction .....  | 5  |
| 1.1 MODAF Certification.....                                  | 5  |
| 1.2 Policy Background.....                                    | 6  |
| 1.3 Aim of this Plan.....                                     | 7  |
| 1.4 Scope.....  | 7  |
| 1.5 Audience.....   | 7  |
| 1.6 References .....  | 8  |
| 2 Objectives of MODAF Tool Certification.....                 | 9  |
| 2.1 Aim.....  | 9  |
| 2.2 Benefits to MOD .....                                     | 9  |
| 2.3 Benefits to Tool Vendors .....                            | 9  |
| 3 Approach.....   | 11 |
| 3.1 Introduction.....   | 11 |
| 3.2 Tool Certification Compared with Tool Selection .....     | 12 |
| 3.3 Definition of a Candidate Tool .....                      | 13 |
| 3.4 Operational Certification Process .....                   | 14 |
| 3.5 Level 1 Tool Certification .....                          | 16 |
| 3.5.1 Level 1 certification approach.....                     | 16 |
| 3.5.2 Level 1 certification process .....                     | 17 |
| 3.5.3 Level 1 certification pre-requisites.....               | 17 |
| 3.5.4 Level 1 certification preparation activities .....      | 18 |
| 3.6 Level 2 Tool Certification .....                          | 18 |
| 3.6.1 Level 2 certification approach.....                     | 18 |
| 3.6.2 Level 2 certification process .....                     | 20 |
| 3.6.3 Level 2 certification pre-requisites.....               | 20 |
| 3.6.4 Level 2 certification preparation activities .....      | 21 |
| 3.7 COI Analysis .....  | 21 |
| 4 Certification Roles.....                                    | 24 |
| 4.1 Logical Roles .....                                       | 24 |
| 4.1.1 Standards Body .....                                    | 25 |
| 4.1.2 Control Board .....                                     | 25 |
| 4.1.3 Certification Body .....                                | 25 |
| 4.1.4 Test Body .....   | 26 |
| 4.2 Governance .....  | 26 |
| 5 Timelines.....  | 28 |
| 5.1 Timeline Inputs and Constraints.....                      | 28 |
| 5.2 Certification Development Roadmap.....                    | 28 |
| 5.3 Timelines for the Operational Certification Process ..... | 30 |

|     |  |    |
|-----|--|----|
| 6   | Summary and Way Forward .....                                    | 31 |
| 6.1 | Summary .....  | 31 |
| 6.2 | Way Forward .....  | 32 |
| 7   | Risks and Assumptions.....                                       | 33 |
| 7.1 | Risks .....  | 33 |
| 7.2 | Assumptions .....  | 34 |
|     | Appendix A – Preliminary Guidance for Certification Testing..... | 35 |
| A.1 | Level 1 .....  | 35 |
| A.2 | Level 2 .....  | 36 |

# 1 Introduction

## 1.1 MODAF Certification

The MOD Architecture Framework (MODAF) is a specification of how to represent an integrated model of an enterprise, from the operational/business aspects to the organisations and systems that provide capability, with appropriate standards and programmatic aspects [4].

MODAF provides a rigorous method for understanding, analysing and specifying capabilities, systems, systems of systems, organisational structures and business processes. Use of MODAF within the MOD, and by its contractors, implies a new way of working that needs to be supported by effective tools and methods. Initial versions of these methods will be developed through early adoption within architecture development activities and communicated through education and training courses across the MODAF user community.

Examination of initiatives similar to MODAF suggests that certification has a potentially valuable role to play in formalising the way in which MODAF may be practiced and supported.

Early work on MODAF certification during the development phase of the MODAF programme resulted in a MODAF Certification white paper [1]. The white paper addressed the potential requirement for certification across:

- Tools
- People
- Training courses.

The white paper enabled a dialogue to be initiated with stakeholders both within the MOD and in industry regarding the potential benefits from MODAF certification and alternative certification approaches. The approaches to certification used in several related fields (including UML and DoDAF) were reviewed.

The main conclusion of the paper was that there are mature models for certification of individuals and training courses but that further work was needed to determine the best mechanism and criteria for certifying architecture support tools for MODAF.

Since the publication of the white paper, the MODAF Technical Group has directed that a plan should be developed for an incremental approach to tool certification [7].

- In the initial stages, a relatively low level of compliance will be acceptable focusing on the presentation of MODAF views. This is intended to encourage tool vendors to develop tools that support the standardised presentation of architecture views.
- Over time a higher level of compliance will be expected in which model interchange capabilities will be thoroughly tested against the MODAF exchange standard [12]. This level of compliance is needed if the MOD is to obtain real benefits from the development of a MOD Architecture Repository, i.e. through the sharing and re-use of architecture products.

There is a subtle relationship between judging the compliance of a MODAF product produced using a given tool and judging the compliance of the tool itself. Certifying that a tool is compliant within a certain domain of application makes the statement that, *if used correctly*, the tool has the capability to produce the full range of compliant MODAF products within that domain. On the other hand, individual MODAF products may be judged compliant based on comparison with examples in the Technical Handbook together with the MODAF Meta Model, where possible. Thus compliant products may be created using non-compliant tools and vice versa. The rationale for certification is the expectation that a compliant tool is more likely to lead to compliant products than a non-compliant one particularly when coupled with education of the user community.

## 1.2 Policy Background

Adequate and considered governance of architecting in the MOD will be key to ensuring that the MOD derives best benefit from the tools available to the MOD architect. An important part of the governance regime will be the policy that MOD architects only use approved tools.

At the present time, extant policy in respect of architecture tools is expressed in an Interim Policy from DEC CCII [2]. This approves three specific 'MODAF convergent' tool solutions for use (although the policy also gives the Integration Authority Group Leader the authority to approve other tools for specific purposes).

These tools have continued to be actively used in different parts of MOD and remain candidates for certification against the MODAF standard. In the meantime, enhancements to several other commercial tools have been designed to provide support to MODAF practitioners. One of the aims of the tool certification programme is therefore to provide a means by which MOD can provide advice to those who wish to select a tool on the relative merits of the different tools.

The Integration Authority assumes that, once the architecting governance regime is in place, the list of approved tools will be based on the MODAF certification programme described in this plan (i.e. this will supersede the interim policy)<sup>1</sup>.

A draft DEC CCII Position Paper [3] is in the process of clarifying the role of MODAF and this provides the provenance for the MODAF tool certification programme that is proposed in this document.

Two other aspects of MOD policy have a significant bearing on MODAF tool certification. The MOD intends to avoid having a single certified architecture tool and, while it recognises UML's role as the preferred modelling language for object oriented systems and business processes, it does not intend to mandate use of UML for defence architecting [1, Section 2.12].

Note: The term '**MODAF Standards**' is used throughout this document as a shorthand for references to the two documents (References 4 and 5) that specify MODAF

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<sup>1</sup> Note that the fact that a tool is approved does not mean that it is a Corporate Application. Approval will most likely take into account the compatibility with the common infrastructure (i.e. DII). This factor needs to be considered in addition to those addressed in respect of certification (which is based on the MODAF standards) if a tool is to be used successfully on MOD fixed networks.

from a technical perspective<sup>2</sup>. All the key documentation are available via [www.modaf.com](http://www.modaf.com).

### 1.3 Aim of this Plan

This deliverable will build on the certification white paper to describe a management framework within which the MOD can effectively conduct certification specifically of MODAF tools. The plan will cover organisational responsibilities, timelines, methods and required data and facilities.

The management framework is intended to provide an input into forward MODAF planning and resourcing. It will mature the concepts from the certification white paper.

The plan has been informed by dialogue with MOD stakeholders (via the MODAF Technical Group) and with commercial tool vendors (via bilateral meetings held between tool vendors and the Integration Authority) [6].

### 1.4 Scope

The focus of this plan is certification of tools that are proposed to provide architectural modelling support to MODAF users. The plan will not address certification of individuals or training courses.

Achieving harmonisation with international partners (particularly the US) is important to reduce the need to undertake costly migration activities in relation to DoDAF based architectural products of UK origin. It is a subsidiary aim of the MODAF certification programme that it should be aligned with associated international certification programmes. However, as this mainly relates to certification of individuals and training courses, this is not a driver for the tool certification process described in this document.

As implementation of the MODAF Taxonomy is not yet funded, the plan will not address those aspects of tool support associated with accessing the future MODAF Taxonomy. It is recognised that this is a shortcoming that will need to be addressed in future implementation of tool certification.

It will fall short of quantifying the resources needed to execute the plan and will not propose a specific contractor support solution nor will it identify the MOD organisations that will fulfil the necessary business roles described in the plan. These aspects will be addressed in a Business Case to be written to support implementation of the actions recommended in this report. It is a management plan rather than an implementation plan.

### 1.5 Audience

The plan has been written to provide a foundation for a Business Case that will enable a programme of tool certification to be implemented. It is therefore aimed primarily at those in MOD who want to understand the approach and benefits of tool certification.

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<sup>2</sup> At the current time, there are inconsistencies between these two documents (because the development of the initial baseline of M3 has led to the need for some changes to the MODAF Technical Handbook) – refer to the M3 release policy note [10].

The plan will also be of interest to those who may wish to undergo certification, namely commercial vendors and other tool implementers.

The lead MOD stakeholder for this document is IA8b Adrian Pearson, the MOD project manager for the MODAF Enablers programme under which this plan has been developed.

## 1.6 References

1. "MODAF Certification White Paper", MODAF/M09/004, version 1, 1<sup>st</sup> September 2005.
2. "Interim NEC, CBM and BMS MODAF Modelling Policy", DEC (CCII) File ses 046-05, 1<sup>st</sup> March 2005.
3. DEC CCII Position Paper (in preparation)
4. "MOD Architectural Framework Technical Handbook", version 1, 31<sup>st</sup> August 2005.
5. "The MODAF Meta Model", IA/13/02-M3, 11<sup>th</sup> April 2006.
6. Tool vendor bilateral meeting notes, [IA/13/02/20060310-Vendor Bilaterals1](#)
7. Meeting notes of the 3<sup>rd</sup> MODAF Technical Working Group held on 18<sup>th</sup> November 2005.
8. XMI 2.1 Specification, OMG specification, <http://www.omg.org/technology/documents/formal/xmi.htm>
9. "Standard for the Representation and Exchange of Product Data (STEP)", ISO 10303 (particularly Parts 31, 34 and 35 addressing conformance testing).
10. "MODAF Meta Model Release Policy", note released on MODAF website on 28<sup>th</sup> February 2006.
11. UML/XMI interoperability testing, <http://www.omg.org/xmitest/>.
12. "XMI, UML and MODAF", version 1, IA/02/16-ERMcm03, 14<sup>th</sup> February 2005.
13. "US Department of Defense Architecture Framework", Version 1.0, 15 January 2003, DoD Architecture Framework Working Group.



## 2 Objectives of MODAF Tool Certification

### 2.1 Aim

The aim of MODAF tool certification is to assess MODAF architecting support tools and publish information asserting the level of compliance of each of those tools with the MODAF Standards.

### 2.2 Benefits to MOD

The benefits to MOD of having a tool certification programme were described in Reference 1.

In summary, the benefits are expected to be:

- reduced cost of the evaluation of architecture support tools across MOD;
- enhanced architecture support (through encouraging tool implementers to provide increasingly high quality tool support);
- reduced risk of MODAF products being non-compliant with the MODAF Standards;
- feedback on the quality of the MODAF Standards (stemming from identification of inconsistencies in their implementation).

Quantification of the benefits to MOD will be addressed in the forthcoming Business Case.

### 2.3 Benefits to Tool Vendors

There are expected to be benefits also to commercial tool vendors and tool implementers as follows:

- opportunity to position and demonstrate the strengths of the vendor's tools against MOD architectural standards;
- opportunity to gain access to the market for tools within the MOD;
- access to an informed community able to provide feedback and guidance on opportunities and priorities;
- access to information helpful in planning future development to target MOD requirements;
- being part of a recognised community of tool providers, with access to opinion and the opportunity to influence the marketplace;
- opportunity to network with other tool vendors to identify benefits from interoperability;
- enhanced interoperability with other tools to satisfy user collaboration needs.

- following successful certification -
  - ability to promote endorsed tools competitively within UK defence market
  - opportunity to leverage MOD endorsement as a wider marketing statement.

Irrespective of the above, realisation of the MOD benefits depends upon commercial tool vendors being motivated to submit their tools for, and achieving, MODAF certification. Tool vendor motivation is linked to [6]:

- The level of investment required to participate in the certification process;
- The extent to which MODAF remains compatible at a semantic level with DoDAF (thereby allowing existing tool support to DoDAF to be extended);
- The extent to which M3 embraces relevant constructs in emerging modelling standards such as SysML and BPMN once they are ratified (as existing tool users in the commercial market will be expecting to receive compatible support for these standards).

The second aspect will be important for international alignment of certification as described in Section 2.1.

## 3 Approach

### 3.1 Introduction

At high level, tool certification aims to take account of two principal factors:

1. The range of views that a tool supports compared with the needs of the different MODAF Communities of Interest (Cols)<sup>3</sup>
2. The degree of compliance that a given tool demonstrates against the MODAF Standards.

The needs of the MODAF Cols vary. These are described in a set of MODAF deskbooks that refer to the MODAF Technical Handbook [4]. The deskbooks describe some MODAF views that are regarded as essential for the conduct of certain business activities and others that are desirable. Support for all the views mentioned in a Col deskbook is required if a tool is to fully support that Col. It is assumed that any MOD-related architecting effort will be associated with one or more of these Cols.

The Technical Handbook [1, Section 2.8] states that architecture development should be supported by tools that will assist the architect in producing consistent view products by performing cross-product checking. The tools should also include a mechanism for storing, updating and retrieving architectural data and their relationships and an ability to automatically generate an integrated dictionary. In addition, the tools should be capable of importing and exporting complete or partial (selected views) architectural data as an XML file conforming to the profile defined in the MODAF Meta Model (M3).

In particular the tools of interest are those that are capable of producing two types of output: MODAF view products and XML data. The primary intention of most architecting efforts is to create an architecture model, i.e. a coherent set of data and view products that conform to the MODAF view definitions relevant to the Col. As architecting practice matures within MOD, interoperability (sharing and re-use) will become an increasingly important factor in tool selection and use<sup>4</sup>. View production and interoperability represent the key drivers for certification.

A tool that is a candidate for selection as a MODAF architecture support tool might therefore be assessed against the following key criteria:

- Production of views: does the tool enable a user to create MODAF view products that reflect the view definitions in the Technical Handbook?
- Cross-view consistency: does the tool help the user to create products that exhibit the consistency between views required by the MODAF Meta Model?
- Model interchange: does the tool implement XML2.1 metadata interchange together with the MODAF Meta Model (import and export)?

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<sup>3</sup> The MODAF Communities of Interest currently are: Customer 1, Customer 2, IPT, Concepts & Doctrine and Sustainment.

<sup>4</sup> It can be expected that architecting practice in the different Cols will mature at different rates which will, to some extent, be influenced by the governance arrangements that are put in place for each Col.

The second criterion implies that the view products generated through use of the tool will be based on a coherent model repository [1, Section 2.9]. The third criterion implies that the model repository can be shared with other users, who do not necessarily employ the same tool. In combination, these criteria will help to ensure that the MODAF community is able to effectively re-use architecture model data without unduly constraining the selection of MODAF tools.

The proposed certification approach is to relate fulfilment of these criteria to two levels of certification as follows:

Certification Level 1: Tool configured for view production + cross-view consistency

Certification Level 2: Level 1 + model interchange.

As certification will be tied to a particular baseline of the MODAF standards, there is an implication that recertification may be required once the MODAF standards are up-issued (which is not expected to occur more frequently than annually). It is expected that the extent of such a recertification will be commensurate with the extent of the changes in the Standards. Note that the statement of MODAF Standards will indicate the baseline of XMI that applies.

### 3.2 Tool Certification Compared with Tool Selection

The proposed tool certification programme aims to establish and maintain authoritative information about the capabilities of tools against the key certification criteria. While this should reduce the need for MODAF users to undertake tool evaluations, it will not entirely eliminate that need.

In general, tool selection decisions made on behalf of a team are based on a range of criteria such as:

- Tool functionality and support to local methods (e.g. tailoring of reporting capabilities to local standards)
- Tool interoperability
- Local infrastructure integration issues
- Cost of ownership
- Familiarity of the tool within the team.

While information relating to the brochure cost of tools might be held centrally, licensing typically happens on a team or site basis so the brochure cost might not be a sound indicator for tool selection purposes.

What MODAF tool certification will provide is an authoritative summary of the key features of the tool from the point of view of compliance with the MODAF Standards. This will enable tool selections to eliminate tools that are non-compliant from consideration before a detailed examination is made of local needs and constraints. Of key importance to tool selection is the level of assurance that MODAF users have that using a given tool will lead to compliant MODAF products. The level of

compliance that the tool has with the MODAF Standards is therefore an important input to tool selection decisions<sup>5</sup>.

### 3.3 Definition of a Candidate Tool

Section 3.1 stated the requirements that a MODAF architecture support tool should ideally satisfy (from the Technical Handbook). These requirements imply that a tool must be repository-based and that, when the same architectural element that is presented in two related MODAF view products, it should be based on the same repository entry.

A tool is regarded as a candidate for MODAF tool certification if it satisfies the following criteria:

- It offers functionality that supports architecture modelling for users in at least one MODAF Community of Interest
- It has a packaged configuration that offers users a consistent set of functionality that relates specifically to the MODAF standard, particularly in respect of
  - the structure of the data repository
  - the view production functionality
  - cross-view consistency checking functionality.

For example, a standard UML tool would not qualify as a candidate for MODAF tool certification because there is no tailoring for MODAF. On similar grounds, drawing packages such as MS Powerpoint or MS Visio would not be considered candidates. However, it might be possible for a configuration of MS Visio to be created (through the use of stencils) that would enable users to create the MODAF views needed by one or more CoIs in a consistent manner. If such a suite of stencils was packaged, the resulting tool would become a candidate tool.

Until a full governance regime for MOD architecting is implemented, tool vendors will be able to offer their tool for certification on a voluntary basis<sup>6</sup>. Once the governance regime is in place, tool vendors will have to submit their tools for certification if these tools are to be used in the Defence environment<sup>7</sup>.

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<sup>5</sup> Achieving compliant products involves appropriate use of approved tools and methods. Of course, this can never be guaranteed simply by selecting a suitable tool. In some cases, compliance would be more likely using a tool with which a team is familiar with than a more sophisticated tool of which they have limited knowledge, at least not without investment in a suitable level of training.

<sup>6</sup> It is understood that the Interim Tool Policy [2] will remain in force until the governance regime is in place. Until then, the IA Group Leader will be able to exercise the discretion granted to him under that policy to approve tools that have successfully passed through a duly accredited certification process and have been demonstrated to be compatible with DII or appropriate MOD local networks.

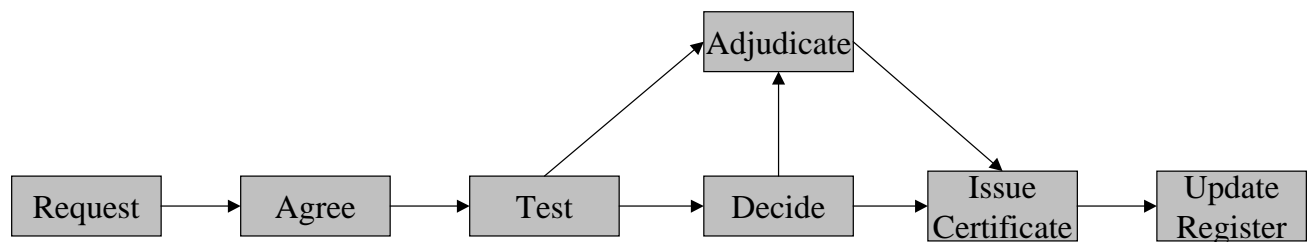
<sup>7</sup> MOD cannot mandate industry to use only the approved tools. However, MOD can insist that industry supplied architectural data satisfies the MODAF interchange standards. In undertaking such an obligation, industry architects would have to employ tools certified at Level 2. A tool could, in principle, be certified but not approved for use within MOD (e.g. if it was incompatible with DII). Such a tool could potentially be used by industry to meet their contractual obligations.

For reasons explained in Section **Error! Reference source not found.**, a tool that only supports the DoDAF viewpoints (Operational, System, Technical) would not be MODAF certifiable for any of the MODAF Communities of Interest<sup>8</sup>.

### 3.4 Operational Certification Process

Development of the Certification capability will be discussed in Sections 4 and 5. Figure 3.1 shows the certification process that will operate once Certification Readiness has been achieved.

It is envisaged that the same management process will apply to candidates irrespective of the level of certification being sought. This will also apply to reappraisals<sup>9</sup>.



**Figure 3-1: Operational Certification Process**

The actors in this process are described in more detail in Section 4. The steps in the process are described below.

#### Request

The tool vendor requests certification and the scope of this is agreed with the Certification Body<sup>10</sup>. This step will involve a simple questionnaire that covers

- the version and commercial status of the candidate tool offered for certification
- the level of certification sought and for which MODAF Communities of Interest
- the MODAF view coverage claimed for the candidate tool
- installation instructions.

<sup>8</sup> One reviewer made the interesting suggestion that a DoDAF Col should be recognised within MOD (e.g. for those working on international projects) – DoDAF is the US DoD Architecture Framework [13]. This might alternatively be regarded as an industry Col for MODAF. If this occurred, there would be no impact on preparations needed for MODAF certification, it being understood that the DoDAF Col would follow the Operational, System and Technical views as defined by MODAF. The relationship between MODAF and DoDAF is discussed in more detail in the M3 document [5].

<sup>9</sup> It is a decision for the Certification Body as to how soon a reappraisal may occur following a failed attempt to achieve certification.

<sup>10</sup> The terms Certification Body, Control Board and Test Body are explained in Section 4.

## **Agree**

The Certification Body will agree to the request once an understanding has been reached with the tool vendor that the candidate tool will be made available to the Test Body and it has been confirmed that the Test Body has the resources to undertake certification testing.

To do this, the Certification Body will undertake a preliminary assessment (aimed at ruling out submissions that would waste the time of the Test Body, i.e. ones that evidently fall short of the requirement). This will probably be possible on the basis of a presentation of the tool by the tool vendor. In discussion with the tool vendor, the Certification Body will agree the CoIs for which tool support is being claimed, and against which the tool will be tested.

For Level 2, agreement will be based on evidence being provided by the tool vendor that the candidate tool is XMI certified.

If there is contention on the Test Body resources, new certifications will take precedence over reappraisals.

## **Test**

The Test Body will carry out a systematic set of tests of the candidate tool based on the scope of certification sought. The Test Body will write a report describing the findings in detail. The report may also provide an informal commentary on features of the tool relevant to tool selection (e.g. performance) which may not be directly relevant to tool certification.

The Test Body may, during the course of testing, come across anomalies in the standards or in the reference implementation. These will be brought to the attention of the Control Board.

The test report will remain confidential and under no circumstances will this be released to other tool vendors. Information relevant to tool selection decisions may be passed to other MOD agencies but recipients will be advised to confirm key features of the tool before making a selection decision.

## **Decide**

On the basis of the test report, the Certification Body will make a decision whether to issue a certificate or not. If a certificate is to be issued, this may record certification at a level lower than that sought. The reasons for the decision will be communicated by the certification body to the tool vendor.

Where the decision is not straightforward (e.g. in cases where the standard tests for some reason appear not to give a fair picture of the features of the candidate tool), the Certification Body may appeal to the Control Board.

## **Adjudicate**

The Control Board is required to react to

- Anomalies brought to the board's attention by the Test Body
- An appeal by the certification body for advice in respect of a certification application or decision.

The Control Board must have the knowledge and authority to enable it to adjudicate on these matters. Since the Control Board's adjudication process will cause a delay in the overall certification process, it should endeavour to respond as quickly as possible.

### **Issue Certificate**

On the basis of the decision made, the Certification Body will either issue a certificate to the tool vendor or not. The reasons for the decision will be communicated by the Certification Body to the tool vendor.

The certificate will specify the Col or Cols for which the tool has been judged appropriate.

As well as the certificate, a statement will be released summarising the strong and weak features of the candidate tool. This is aimed at making the tool vendor aware of areas for future improvement.

The tool vendor may also apply to the Control Board if it feels that the outcome is unfair or the process is flawed.

### **Update Register**

The Certification Body will update the register of certified tools. This register is expected to be publicly available, i.e. available to both MOD personnel and industry.

## **3.5 Level 1 Tool Certification**

The aim of Level 1 certification is to ensure that tools used for architecture modelling within the MOD obtain a minimum level of compliance with the combined set of view definitions within the MODAF Technical Handbook [4].

The scope of the Level 1 certification testing will be dependent upon the Col or Cols for which tool support is claimed by the tool vendor as agreed with the Certification Body.

The relationships between views are described in the Handbook and also in the M3 documentation [5]. In particular, Section 2 of the M3 documentation provides a summary description of the key M3 elements (across all viewpoints) and how they relate to each other.

### **3.5.1 Level 1 certification approach**

The certification approach for Level 1 will consist of the creation of a number of sample views and checking the compliance of these view products and cross-product relationships against the MODAF Technical Handbook [4], referring to the MODAF Meta Model [5].

Examples of MODAF consistency rules are presented in Appendix A.

The approach requires a reasonably in depth understanding of how the tool is to be used to create MODAF view products. It is therefore recommended that the tool vendor be asked to provide the Test Body with either training or suitably competent staff to enable the Test Body to efficiently and effectively use the tool.



### 3.5.2 Level 1 certification process

The steps in the Level 1 certification process are as follows:

1. Install the tool and ensure that basic navigational functionality (for navigation across the view products), view/model editing functionality access to data definitions are available to the testers.
2. Select a Test Set appropriate to the Col support claimed.
3. Following the Level 1 Test Script, examine the view products provided by the tool vendor for compliance with the MODAF Standards in respect of view content and cross-product consistency (referring to the simplified presentations of M3 contained in Section 2 of the M3 documentation [5]).
4. Following the Level 1 Test Script, examine the model data underpinning the view products for basic consistency with the MODAF Meta Model. This will again make use of the material in Section 2 of the M3 documentation [5].
5. Use the tool to create new view products covering the Test Set in accordance with the Level 1 Test Script ensuring these view products re-use some of the existing model elements. Check the consistency of the relationships and the re-use of elements that occur in multiple views.
6. Check the degree of integration of the AV-2 taxonomy with the model repository ('one version of the truth') and with OWL-based taxonomies.

### 3.5.3 Level 1 certification pre-requisites

A number of examples of MODAF views are needed in order to test compliance (Level 1). Ideally there would be a complete set of views, relative to the Cols of relevance to the certification activity, with variations of format as needed to cover the expected format variants (e.g. UML and non-UML and tabular and non-tabular where applicable). These could be based on the examples in the Handbook but extended to ensure that the tool can handle a realistic level of complexity (e.g. an OV-2 with six operational nodes, some featuring nesting relationships).

As a target it is proposed that two Test Sets are developed for each of the five MODAF Cols (ten in all). Each Test Set would have at least eight view products. As a certain degree of sharing of these between Cols is expected, this requires the development of at least 40 view products in total<sup>11</sup>. The AV-2 product would be a mandatory member of each Test Set (the testing will check that this is truly an integrated data definition dictionary).

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<sup>11</sup> Bear in mind that there are currently 30 different MODAF views, including AV-1 and AV-2.

### 3.5.4 Level 1 certification preparation activities

- Analyse the cross-product consistency rules in order to determine a number of suitable Test Cases, these being envisaged as consisting of threads of model creation activities both with a Viewpoint (e.g. spanning OV-5, OV-2, OV-3) and between Viewpoints (e.g. OV-2 with SV-1).
- Use a drawing tool to create a representative range of examples of MODAF view products, starting from the Handbook examples (this will probably be a resource-limited activity)<sup>12</sup>. The examples will be selected to illustrate the tool's adherence to the consistency rules (although it is intended to test view production also).
- Group these into Col-specific Test Sets.
- Create a Level 1 Certification Test Plan based on the process described above, including the employment of the Test Sets and Test Cases.
- As part of the accreditation process, confirm through an independent review of the material that the examples provide a fair and unbiased test of the tools' cross-view support capabilities.
- Create Level 1 Certification Test Scripts to ensure that the certification procedures can be applied systematically.

## 3.6 Level 2 Tool Certification

The aim of Level 2 certification is to ensure that the products delivered as a result of architecture activities undertaken within the MOD are compliant with the MODAF Standards so that they are able to be effectively shared and re-used. Re-use is required at the level of architecture description, view product and individual model elements.

The standard for compliance is the MODAF model interchange standard which has been agreed to be the open standard XMI2.1 [8] configured by the MODAF Meta Model (M3) [5,]. Further background can be found in Reference 12.

### 3.6.1 Level 2 certification approach

The MODAF Level 2 certification approach depends upon prior certification of a candidate tool's XMI capability. As XMI is an open standard, independent certification is available to tool vendors, e.g. from the OMG [11]. This will considerably reduce the effort required by MOD to test compliance with the MODAF model interchange standards.

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<sup>12</sup> The collection of views could be built up over time. With permission from tool vendors, view products based on sample models could be included in the collection (for testing other tools). Note that the testing may only require hard copies of view products and these are available from a number of sources.

The certification approach for Level 2 will consist of the two way exchange of a model consisting of a number of sample MODAF view products between the candidate tool repository and the reference repository. Testing will be based on a combination of

- Direct examination of the XMI data products generated by the candidate tool
- Use of a MODAF compliant reference repository to create models/views based on the XMI data imported from the candidate tool
- Testing the candidate tools' XMI import mechanism including use of the 'reverse trip'.

To facilitate control of the testing, it is preferable that the candidate tool is installed at the test Body and that there is a reliable network connection with the MODAF compliant reference repository.

The approach will make use of a sample model developed by the tool vendor (for reverse trip via the MODAF compliant reference repository back to the candidate tool) and a similar model in the reference repository (for reverse trip via the candidate tool back to the reference repository). It will be necessary to have a presentation copy of the tool vendor model itself (for comparison purposes), e.g. in html format.

During review there has been some discussion of an alternative strategy to Level 2 certification that does not rely on the reference repository. This is based on a 'tool vendor round table' approach (similar to that used by STEP [9]). Under this approach at regular intervals, tool vendors could be gathered under 'Chatham House rules' to technically review their products against the standards and emerging developments. An output report from the workshop could detail the numbers of applications that meet the various aspects of conformancy (in particular model interchange) but confidentiality would need to be respected. Peer pressure within the vendor community is then the driver for tool improvements.

This alternative has been considered but is regarded only as a fall-based solution for the following reasons:

- MOD does not directly have a need for two architecture tools to interoperate with each other but it does have a need for all architecture tools to interoperate with the MOD architecture reference repository (as emphasised in the six stage architecture development process described in the MODAF deskbooks, the key model interchange requirement is for sharing, re-use etc via the MOD repository)
- Use of a reference repository as a reference implementation does not preclude round table and bilateral engagement (indeed, to some extent, the latter is already happening, at least in respect of ISSE tool interoperability); however, you cannot have a certification process without some form of certification testing – such a process is needed to provide the guidance to those within MOD whose responsibility it is to select tools for MODAF use
- If interoperability issues were to arise in respect of alternative, but apparently equally valid, implementations of the MODAF interchange standards in the reference repository and one or more tools, then the implications of changes to the MOD repository for already certified tools would have to be taken into account.

The latter point implies that the status of the reference repository would grow as more tools achieve Level 2 certification against it. Nevertheless, in the interim

period the round table approach could be used as a means to improve interoperability between MODAF tools certified at Level 1.

### 3.6.2 Level 2 certification process

The steps in the Level 2 certification process are as follows:

1. Confirm that the necessary XMI certification has been achieved.
2. Install the tool at the facilities run by the Test Body and ensure that a reliable network connection exists with the reference repository.
3. Select a Model Test Set in the reference repository and confirm the extent of the tool vendors sample model appropriate to the Col support claimed.
4. Following the Level 2 Test Script, export a set of XMI data from the candidate tool and directly examine the XMI data for compliance with the MODAF Standards (e.g. correct use stereotyping, taxonomy referencing and naming conventions) by comparison with a reference XMI data set.
5. Following the Level 2 Test Script, import the XMI data into the reference repository and create model/view presentation based on it.
6. Following the Level 2 Test Script, perform a reverse trip for the tool vendor model and examine the re-imported model data in the candidate tool.
7. Following the Level 2 Test Script, perform a reverse trip for the Model Test Set and examine the re-imported model data in the reference repository.

### 3.6.3 Level 2 certification pre-requisites<sup>13</sup>

The main pre-requisite is having a reference repository which has been accredited by the Certification Body as providing a reference implementation of the MODAF interchange standard (i.e. XMI2.1/M3). It is important that the accreditation process is transparent and conducted impartially<sup>14</sup>.

It is assumed that reference XMI data sets will be created as part of the development, test and accreditation of the reference repository and that these will be suitable for Level 2 certification.

The repository issue is within DG Info's remit and will be addressed as part of a broader review of the MODAF concept of use.

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<sup>13</sup> During review it was suggested that reference information be created in accordance with the approach used for conformance testing within STEP [9]. That approach was assessed during production of the certification white paper [1] which concluded that the formality of the STEP approach was inappropriate for MODAF given the relatively small number of tools to which MODAF certification will apply. Nevertheless it is recommended that implementers of Level 2 certification use Reference 12 as a guide since the logical organisational roles have been based on this source (see Section 4).

<sup>14</sup> The accreditation process for the repository could be conducted using an approach similar to that described in the last sub-section. Manual examination of samples of the XMI outputs by Subject Matter Experts will be required. It is believed that there is sufficient expertise within the defence industry that has the necessary independence from the tool vendors involved.

### 3.6.4 Level 2 certification preparation activities

- Analyse areas in MODAF where XMI-based model interchange may prove challenging (e.g. taxonomy referencing) and select a number of suitable Model Test Sets based on the output from the reference repository development (the Test Sets will include sample view products and the corresponding XMI export data files).
- Assess the cost and feasibility associated with alternative options for implementing an automated or semi-automated process for comparing XMI data files.
- Create a Level 2 Certification Test Plan based on the process described above, including the employment of the Model Test Sets (the two reverse trips should provide adequate Test Cases).
- As part of the accreditation process, confirm through an independent review of the material that the examples provide a fair and unbiased test of the tools' model interchange capabilities.
- Create Level 2 Certification Test Scripts to ensure that the certification procedures can be applied systematically.

## 3.7 COI Analysis

The following table describes the MODAF views that are relevant to each Col based on the MODAF Col deskbooks<sup>15</sup>. The contents of the table will change as the deskbooks evolve. The scope of certification will keep pace with such changes. The table should therefore not be viewed as definitive at this point in time.

One finding from this survey is that a tool that is only DoDAF compliant will not meet the essential needs of any of the Cols since each Col has essential requirements in both the Strategic and Acquisition MODAF viewpoints. Without extension, such a tool would not therefore be certifiable as being MODAF compliant.

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<sup>15</sup> The deskbooks distinguish between views that are provided as input from another Col and those that are created by the Col. While the tool functionality to view existing MODAF products is different to the tool functionality to actually create them, this distinction has been ignored in the table (since, ideally, all imported model elements will be available for re-use within the recipient tool). Some desirable views shown in the table are not explicitly identified in the deskbooks.

|                    | <b>IPT</b> | <b>C1</b> | <b>C2</b> | <b>C&amp;D</b> | <b>Sust</b> |
|--------------------|------------|-----------|-----------|----------------|-------------|
| <b>All Views</b>   |            |           |           |                |             |
| AV-1 <sup>16</sup> | E          | E         | E         | E              | E           |
| AV-2               | E          | E         | E         | E              | E           |
| <b>Strategic</b>   |            |           |           |                |             |
| StV-1              |            | E         | E         | E              | E           |
| StV-2              | E          | E         | E         | E              | E           |
| StV-3              | E          | D         | D         | D              | E           |
| StV-4              |            |           | D         | D              |             |
| StV-5              | D          |           | E         |                | E           |
| StV-6              | E          | E         | E         |                | E           |
| <b>Operational</b> |            |           |           |                |             |
| OV-1               | E          | E         | E         | E              | E           |
| OV-2               | E          | E         | E         | E              | D           |
| OV-3               | E          | E         | E         | D              | E           |
| OV-4               | D          | D         | E         | E              | E           |
| OV-5               | E          | E         | E         | D              | E           |
| OV-6               | D          |           | E         | D              | D           |
| OV-7               | D          |           | E         | D              | E           |

**Table 3-1: Essential (E) and Desirable (D) MODAF views required by each MODAF Community of Interest (Part 1)**

<sup>16</sup> AV-1 is an essential tool for management of architecture activities. It is not regarded as essential that AV-1 is integrated with other views in the same tool/repository, i.e. an architecture tool may choose to integrate it or not.

|                    | <b>IPT</b> | <b>C1</b> | <b>C2</b> | <b>C&amp;D</b> | <b>Sust</b> |
|--------------------|------------|-----------|-----------|----------------|-------------|
| <b>System</b>      |            |           |           |                |             |
| SV-1               | E          | D         | E         |                | D           |
| SV-2               | E          |           | E         |                | D           |
| SV-3               | E          | D         | E         |                | D           |
| SV-4               | E          | D         | E         |                | D           |
| SV-5               | E          | D         | E         |                | D           |
| SV-6               | E          |           | D         |                | D           |
| SV-7               | E          |           | E         |                | D           |
| SV-8               | E          |           |           |                | D           |
| SV-9               | E          |           |           |                | D           |
| SV-10              | D          |           |           |                | D           |
| SV-11              | D          |           | E         |                | D           |
| <b>Technical</b>   |            |           |           |                |             |
| TV-1               | E          | E         | E         | E              | E           |
| TV-2               | E          |           |           | E              |             |
| <b>Acquisition</b> |            |           |           |                |             |
| AcV-1              | D          | D         |           |                | E           |
| AcV-2              | E          | E         | E         | E              | E           |

**Table 3-2: Essential (E) and Desirable (D) MODAF views required by each MODAF Community of Interest (Part 2)**

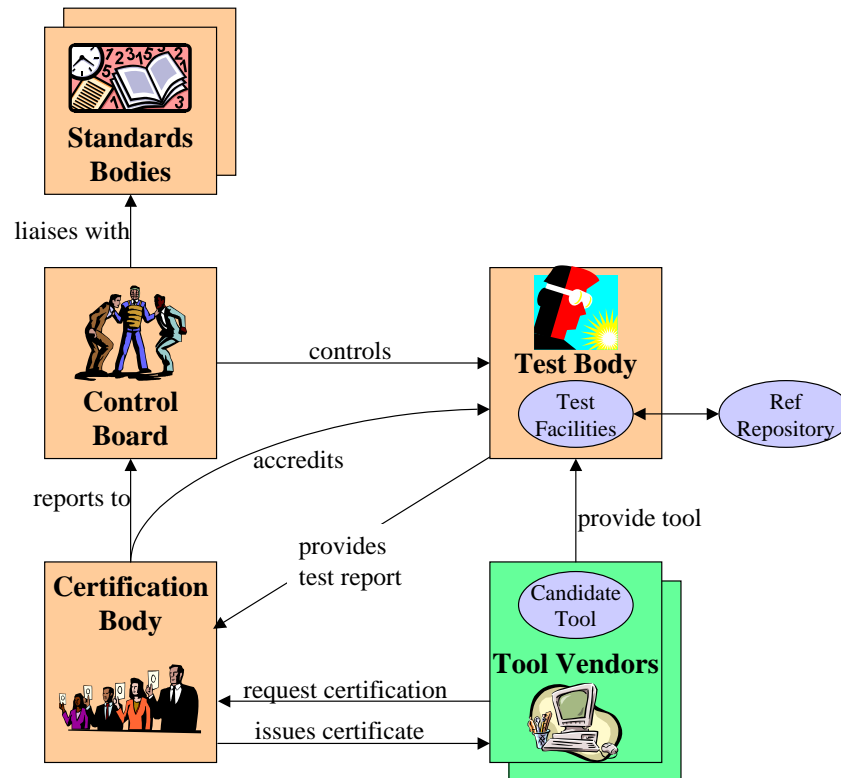
Reference to both Essential (E) and Desirable (D) views will provide the certification process with a degree of flexibility. While full compliance requires tool support for all views (both E and D) in support of a Col, there may be scope for providing a certificate with caveats where there is a shortfall in one or two Desirable views<sup>17</sup>.

<sup>17</sup> This is one instance where the Certification Body would need ratification from the Control Board. This could occur as a result of the difficulty some UML tools might have creating tabular or timeline views, for instance.

## 4 Certification Roles

### 4.1 Logical Roles

Figure 4-1 provides an overview of the logical roles that are required to implement the certification processes described in Section 3. The functional responsibilities of each logical role are described in the following sub-sections<sup>18</sup>.



**Table 4-1: Functional structure for tool certification**

For convenience the term ‘tool vendor’ will be used to refer to an organisation offering an architecture tool for MODAF tool certification. Candidate tool vendors need not be commercial organisations.

It should be borne in mind that it is not expected that more than ten tools will be offered for MODAF certification in the foreseeable future. Therefore due regard to the scale of certification should be made during implementation of the process.

<sup>18</sup> The origin of this organisational structure is the STEP Certification process [8], as discussed in [1]. The structure has been further simplified compared with that proposed in [1].



#### 4.1.1 Standards Body

There are two Standards Bodies related to MODAF:

- The Object Management Group (OMG), which controls the XMI model interchange standard
- DG INFO<sup>19</sup>, which controls the MODAF Standards and releases of up-issues of the MODAF documentation.

A particular version of the MODAF Standards will specify a particular baseline of the XMI standard.

#### 4.1.2 Control Board

The Control Board is responsible for determining the testing and certification principles and ensuring that a single interpretation of the standard is maintained. The Control Board defines:

- What should be tested and certified – described in Section 3 - referencing the applicable standards.
- How the testing should be performed – described in Section 3.
- The Control Board will have relationships to other functions and organisations, as follows:
  - Liaison with similar function identified for DoDAF, etc. to promote harmonization of testing and certification.
  - Arbitrator for disputes between Certification Body and Tool Vendors.
  - Raising issues with the MODAF standard, the XMI standard or the reference implementation detected through developing test suites, or raised by the Test Body as a result of practical experience of carrying out certification tests
  - Advising on the implications for tool certification of a proposed change to the MODAF Standards (including timing of any up-issue of the MODAF documentation and related tool vendor communications).

#### 4.1.3 Certification Body

The Certification Body is the first point of contact for Tool Vendors. It is to the Certification Body that the Tool Vendor presents a request for certification.

The Certification Body must be independent from the Test Body.

The Certification Body is responsible for issuing Certificates based on the presentation of a valid test report from an accredited Test Body. The Certification body should maintain a list of accredited Test Body and make this available to prospective test subjects.

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<sup>19</sup> DG INFO has taken over ownership of MODAF from DEC CCII.

The Certification Board is also responsible for ensuring that the Test Body meets and maintains the required standards for accreditation<sup>20</sup>. This covers aspects of capability to perform testing, impartiality with respect to the candidates, repeatability of the testing and confidentiality of the test results.

The Certification Board reports to the Control Board. In particular, the Certification Board will seek ratification from the Control Board of any waivers or exceptions relating to the issuing of certificates.

#### 4.1.4 Test Body

There will be a single Test Body accredited to perform tests in support of MODAF certification. The Test Body might, in the first instance, consist of a few experienced personnel.

The Test Body is responsible for testing a candidate tool for compliance with MODAF, and based on tests performed issuing a test report. To perform the testing the Test Body must:

- Have or make available facilities suitable for performing the testing including a 'test harness' (and test models) which is fully MODAF-compliant
- Generate actual tests based on the test suites defined by the Control Board
- Test the candidates using the actual tests in a controlled environment
- Provide test reports to the Certification Body following testing
- Report issues with test suites or interpretation to the Control Board.

## 4.2 Governance

Governance refers in the first instance to the assignment of specific MOD organisations to each of the roles described in Section 4.1.

There is also a need to define grievance procedures to cover the following situations:

- A candidate tool vendor disputes the constitution of the certification body (e.g. on the grounds that it will not be impartial)
- A candidate tool vendor disputes the factual basis for a certification decision, i.e. the evidence created as a result of the tool certification process
- A candidate tool vendor disputes the judgmental basis for a certification decision (but not the evidence on which that decision is based)
- A candidate tool vendor complains that sensitive information has been promulgated by the certification body<sup>21</sup>

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<sup>20</sup> A separate Accreditation Body may be required if there were more than one test facilities in the future.

<sup>21</sup> Note that it is likely that a candidate tool vendor would regard rejection by the certification body as sensitive information.

- A candidate tool vendor feels that it has not been treated openly and fairly by the certification body (perhaps in comparison with other candidates).

Definition of the detailed governance arrangements is outside the scope of this plan.

During review of the plan, some suggestions have been made as to the mapping of the logical roles to MOD organisations. A possible mapping is as follows:

- DG Info – Control Board
- DCSA (e.g. CBA IPT) – Certification Body
- Integration Authority – Test Body.

## 5 Timelines

### 5.1 Timeline Inputs and Constraints

Direction from the MODAF Technical Working Group was for a phased implementation of tool certification [7].

The main timescale drivers for the achievement of a viable MODAF tool certification programme are:

- the date at which this plan is endorsed (i.e. the way forward in Section 6.2 is actioned)
- the time required to develop and get approved the necessary Business Cases and to put in place the governance arrangements referred to in Section 4.2
- the time at which MODAF documentation has be updated to achieve consistency with M3 version 1
- the time required to undertake the technical preparation activities discussed in Section 3.6
- the time required to establishment of a fully MODAF-compliant reference implementation.

In order to develop a timeline within this plan, the following timeline assumptions have been made:

- 30<sup>th</sup> June 2006 has been assumed as the date by which the MODAF Technical Handbook will have been updated and the Level 1 certification Business Case will have been approved
- 15<sup>th</sup> November 2006 has been assumed as the date by which the reference implementation will have been achieved and the Level 2 certification Business Case will have been approved.

The timelines will be reviewed and revised as part of the Business Case development process.

### 5.2 Certification Development Roadmap

Figure 5-1 presents the development programme leading up to Certification Readiness Dates at Level 1 and Level 2 respectively. Green bars indicate tasks relating to organisational development and the establishment of the associated governance arrangements (approval timelines have been removed).

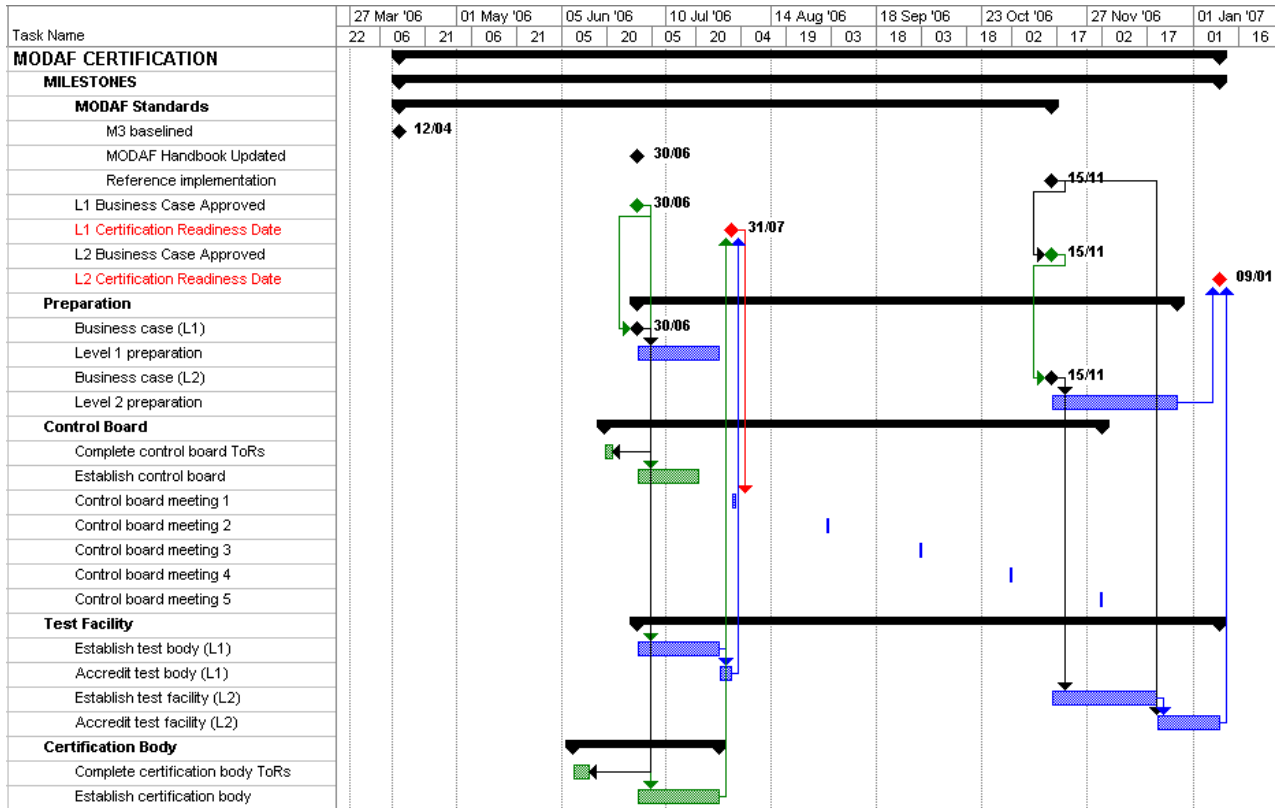


Figure 5-1: Certification development roadmap

It should be emphasised that the timeline for realisation of an initial certification programme is heavily dependent upon the speed with which a Business Case can be developed, approved and implemented from a staffing point of view. Some activities are regarded as being part of the Business Case development process.

The development roadmap provides the key milestones shown in Table 5-1.

| Milestone  | Timeline |
|--|----------|
| Level 1 Certification Readiness Date (relative to Level 1 approval date) | 1 month  |
| Level 2 Certification Readiness Date (relative to Level 2 approval date) | 2 months |

Table 5-1: Certification realisation timelines relative to approval dates

### 5.3 Timelines for the Operational Certification Process

The generic process was described in Section 3.2. The time required to complete this process will depend upon the level of certification.

The time is measured from the date that an agreement has been reached that a certification activity will take place and the candidate tool has been successfully installed at the Test Body to the issue of the certificate.

The target and maximum times are shown in Table 5-2.

| <b>Level</b> | <b>Target Time</b> | <b>Maximum Time</b> |
|--------------|--------------------|---------------------|
| Level 1      | 6 weeks            | 8 weeks             |
| Level 2      | 10 weeks           | 15 weeks            |

**Table 5-2: Timelines for Operational Process**

## 6 Summary and Way Forward

### 6.1 Summary

This document provides a development management plan for the immediate way forward for MODAF tool certification. This is intended to be input to a Business Case to be written to support implementation of the actions recommended in this report. It is recommended that a phased approach to certification is taken, with two levels of certification (Level 1 and Level 2) covering model coherence and model interchange respectively. Certification activities are scoped by the needs of the MODAF Communities of Interest (Cols) as expressed in the MODAF Deskbooks<sup>22</sup>. A tool might then be certified at Level 1 for one Col and at Level 2 for another Col<sup>23</sup>.

Table 3-1 provides one interpretation of the Col requirements – this is subject to change and will need to be reviewed at the outset of a certification programme. One limitation of this plan is that it refers only to certification of stand-alone tools. In practice, a range of tools could be used (e.g. different tools for Customer and Supplier) and it might be perfectly acceptable for tools used by industry contractors to not have the capability to address Strategic or Acquisition views (as these might be expected to be created by MOD with industry input as necessary)<sup>24</sup>. The MODAF tool certification programme will therefore be influenced by the emerging concept of operations for MODAF, in particular the development of one or more architecture repositories and the associated governance arrangements.

The plan identifies the recommended approach and the activities that need to take place in order for a credible certification programme to be put in place. These activities include both technical development activities (e.g. development of test scripts) and business approvals (e.g. development of a successful Business Case). The focus in this document has been on the technical activities.

A timetable has been produced to provide a basis for constructing a Business Case and more detailed implementation plan.

Risk and assumptions associated with tool certification are listed in Section 7.1 and Section 7.2 respectively. It is recognised that accreditation of the reference implementation upon which Level 2 certification is dependent would need to be included within the scope of work for the associated repository development activity.

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<sup>22</sup> The scope of certification against a particular Col will change as the deskbooks evolve. There is, of course, considerable overlap in the needs of different Cols.

<sup>23</sup> Care is needed that tool vendors do not claim MODAF compliance unless they have satisfied the needs of all Cols.

<sup>24</sup> See footnote 8 earlier in the document.

## 6.2 Way Forward

It is recommended that

- The Integration Authority takes the necessary steps to obtain MOD stakeholder buy in to the tool certification plan (via the MODAF Technical Working Group) and ensures that DG Info appreciates the need for alignment between the future governance arrangements and the tool certification approach.
- The Integration Authority communicates the outline of the tool certification approach to tool vendors through the ongoing bilateral discussions and places the detailed plan in the public domain once approved.
- DG Info identifies the MOD organisations that can, and are willing to, take on the roles of Control Board, Certification Body and Test Body outlined in Section 4 of this plan.
- Guided by DG Info, the MODAF User Group approves the contents of this plan and agrees a realistic timetable for its implementation, taking into account the forward plan for the reference repository and updates to the MODAF documentation following the initial baselining of M3.
- The Integration Authority develops an implementation strategy addressing at least the Level 1 Certification Process in the first instance (a formal Business Case might not be necessary if it is agreed that the Level 1 process will be conducted by in house staff).
- The designated Certification Body identifies resources having the qualifications and capability to take on certification and accreditation responsibilities outlined in this plan.



## 7 Risks and Assumptions

### 7.1 Risks

Table 7-1 lists the risks associated with the MODAF Tool Certification Programme.

| ID | Risk  | Mitigation Strategy   |
|----|---|---|
| R1 | MODAF standards are not stable  | <ul style="list-style-type: none"> <li>▪ M3 release/update policy – M3 to be fixed for 12 months</li> <li>▪ MODAF documentation will align with M3 in due course</li> </ul>   |
| R2 | Tool certification Business Case fails or is delayed                        | <ul style="list-style-type: none"> <li>▪ The Do Minimum option is to use the tool certification plan (this document) to guide MOD organisations in respect of tool selection</li> </ul>   |
| R3 | A currently approved tool fails certification                               | <ul style="list-style-type: none"> <li>▪ This is a risk in the sense that these tools are already in use within MOD and a certification failure might jeopardise work in progress (albeit only when the architecture governance regime is in place)</li> <li>▪ Progressive approach intended to set the bar such that MODAF convergent tools will be able to achieve Level 1 with minimal investment</li> <li>▪ Architecting governance will supersede the interim tools policy in time (the interim 'approval' of tools did not involve any technical evaluation)</li> </ul> |
| R4 | Tool certification does not attract candidates                              | <ul style="list-style-type: none"> <li>▪ Attention is being paid to the concerns of stakeholders in respect of MODAF standard</li> <li>▪ Benefits to tool vendors described in this plan</li> <li>▪ The necessity of certification will be reinforced when certification becomes an instrument of governance (Assumption A1)</li> <li>▪ The 'mandation' of use of MODAF will enhance attractiveness of MODAF-compliant tools</li> </ul>   |
| R5 | Reference implementation is not accepted by tool vendors                    | <ul style="list-style-type: none"> <li>▪ Fall back approach is tool 'plug-fest' (i.e. tool-to-tool interoperability testing)</li> </ul>   |
| R6 | XMI2.1 is not implemented by tool vendors (or not consistently implemented) | <ul style="list-style-type: none"> <li>▪ XMI2.1 was ratified in September 2005</li> <li>▪ This requires review before Level 2 certification is progressed to an implementation plan</li> </ul>  |

**Table 7-1: MODAF Tool Certification Risks**

## 7.2 Assumptions

Table 7-2 lists the assumptions associated with the MODAF Tool Certification Programme.

| ID | Assumption  | Status <sup>25</sup> |
|----|---|----------------------|
| A1 | The future MODAF/EA governance regime will be consistent with this tool certification plan  | Accepted             |
| A2 | The Business Case for implementation of the MODAF tool certification is successful and the certification programme is funded  | Accepted             |
| A3 | An implementation programme for a MODAF compliant reference repository will be funded and will be scoped to include production of reference XMI data sets for each view   | Accepted             |
| A4 | The MODAF documentation will be updated to achieve consistency with M3 version 1  | Accepted             |
| A5 | The MODAF Standards will not be up-issued more frequently than on an annual basis   | Accepted             |
| A6 | Tool vendors will support the MODAF tool certification process at no cost to MOD (where appropriate this may include having tool vendor representatives embedded with the test team during certification testing) | Accepted             |

**Table 7-2: MODAF Tool Certification Assumptions**

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<sup>25</sup> The review process for this plan will provide the mechanism for taking an assumption through its life-cycle from Candidate to Accepted.

## Appendix A – Preliminary Guidance for Certification Testing

This appendix contains some preliminary observations on the preparation required for Level 1 and Level 2 certification testing. It provides examples at the detailed level which indicate the depth of the work needed.

### A.1 Level 1

In preparing for Level 1 certification testing, a set of atomic MODAF consistency rules needs to be drawn up. These are drawn from the MODAF Standards, but specifically Section 2 in the M3 documentation [5]<sup>26</sup>.

Examples of consistency rules that span the various MODAF viewpoints are as follows:

- a. A System Port Connector (depicted on a SV-2b) should map on to a System Connector (SV-1) since each of the two System Ports associated with the ends of a System Port Connector is a component part of a System (SV-2a).
- b. A System Connector (SV-1) should map on to a Needline (OV-2) since each of the two Systems associated the ends of a System Connector (SV-1) maps onto a Node via the Node Realisation construct and the mappings between Systems, Physical Assets and Capability Configurations (StV-5).
- c. If a Capability supports an Enduring Task (StV-6), and is fulfilled by a Capability Configuration (StV-3) that realises a Node (SV-1) then at least one of the Operational Activities conducted at that Node (OV-2) must support the same Enduring Task (OV-5).
- d. If an Organisational Resource is a user of a System (via a System Usage construct) that is hosted on a Physical Asset (via a Hosting), then the Organisational Resource must be deployed to the same Physical Asset (via an OrganisationalDeploymentToAsset).
- e. An Information Element (OV-3) must be part of a Logical Data Model (OV-7).
- f. A System Connector (SV-1) may map onto one or more Information Exchanges (OV-3) as a result of the Connection Realises IER construct (SV-6).
- g. If a Project delivers a Capability Configuration (Configuration Of Project Deliverable - AcV-2), then that Capability Configuration must fulfil one of the Required Capabilities (Capability Fulfilment - StV-1) that the Project aims to deliver (Project Aims To Deliver - AcV-2).

Based on examination of the DoDAF consistency rules, there might be expected to be a total of the order of 80-100 MODAF consistency rules that could be identified in preparation for Level 1 certification testing<sup>27</sup>.

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<sup>26</sup> Note that the DoDAF documentation [13] contained a specific section (Volume II, Section 7) that documented the consistency rules. Using M3, it is possible to define these more precisely for MODAF, e.g. by specifying the MODAF construct that realises a mapping between two concepts.

<sup>27</sup> There is a total of 98 separate consistency rules identified in the DoDAF section cited in the previous footnote. As these are listed view by view and tend to be binary associations, this suggests

As an example, a test script that was aimed at the first consistency rule might contain the following instructions:

1. Create an SV-1 diagram and model two systems with a system connection.
2. Create an SV-2a diagram, add the two previously defined systems and give each a port.
3. Add the systems and ports to a new SV-2b diagram.
4. In the SV-2b diagram, connect the previously defined ports with a port connector.
5. Add the previously defined systems, ports and port connector to a new SV-2c diagram.
6. Demonstrate that it is possible to associate the port connector defined in Step 4 with the system connector defined in Step 1 (this association will be an instance of the `SystemPortConnectionMap` stereotype).

Note that it would be possible to amend the test script so that it checks the consistency rule at the repository level without referring to the creation of the SV-1, SV-2a, SV-2b and SV-2c view products. The revised script would consist of steps that successively create repository elements that are instances of each of the `System`, `SystemConnection`, `SystemPort`, `SystemPortConnection` and `SystemPortConnectionMap` stereotypes in turn, together with the correct linkages between them.

Such a test would not test conformance with the view definitions in the MODAF Technical Handbook that refer to the development of specific views that depict the system and port connections. It would therefore not confirm the correctness of the tool operation at Level 1 for, say, the IPT Community of Interest which needs to work with these view products.

## A.2 Level 2

In preparing for Level 2 certification testing, XMI data sets need to be created for a number of pre-prepared MODAF view products. These examples will be based largely on the examples in the MODAF Technical Handbook [4] with the corresponding XMI dataset derived from the corresponding sections in the M3 documentation [5].

For general background to the approach, see Reference 12.

During development of the XMI approach at an earlier stage of MODAF development, some XMI data sets were created. These were not, however, included in the Technical Handbook pending development of M3. These data sets could be used as a starting point but would need to be refinement to align with the initial M3 baseline.

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there are around 50 actual rules. MODAF has two more viewpoints than DoDAF and is more integrated so it can be expected to have correspondingly more consistency rules.

Such XMI data sets would need to be generated during testing and accreditation of the MODAF compliant reference repository and thus should be covered in the implementation plan for the reference repository. Note that this may or may not involve testing the XMI data output via manual inspection.