

1.0 Introduction

The TickIT scheme [1] ensured competence in the certification of ISO 9001 certified organisations whose Quality Management System contained procedures for software development. Certification bodies offering TickIT would provide IT specialist assessors to audit the quality management of software development. National Physical Laboratory had held TickIT certification ever since it achieved ISO 9001 certification in 1996.

2.0 The National Physical Laboratory

The National Physical Laboratory is the UK's National Measurement Institute, and is a world-leading centre of excellence in developing and applying the most accurate measurement standards available. It employs approximately 3000 staff.

NPL has made many contributions to modern-day computing [7, 8]. To this day, mathematicians and computer scientists provide vital support to NPL [9].

2.1 Software Quality Management at NPL

Quality management of the development and procurement of software is an essential part of NPL's ISO 9001 certified Quality Management System [10].

Much of the software is developed in-house by NPL's staff. Commercial off-the-shelf packages are also used, along with software developed by third party

contractors. The software is developed using some of the following tools and methods:

any source code / spreadsheet / database and documentation). Any input or output files must also be available. This principle applies whether the number is a calibration value quoted on a certificate or the amount of a project budget spent over a particular period of time.

- **Transferability**

If the original developer or user of a piece of software / spreadsheet database hands it over to someone else, it needs to be easy to explain how it works and to prove that it works. Handover must also be possible even if the original developer is no longer available.

- **Maintenance**

Understanding how documented code works is easier than trying to understand undocumented code. As stated above, the correct version of any source code etc. must be readily available. Other information required to modify the software (e.g. enhancement requests or bug fixes) must also be easy to obtain. All of the above must be obtainable without having to consult the original developer(s) who may be unavailable.

Examples of typical situations to be considered include:

2.1.3 Risk Analysis

- TickITplus provides a mechanism and vocabulary whereby project managers and senior management, who are not necessarily programmers or

A Process Reference Model (PRM) was compiled which maps existing NPL corporate and software quality management procedures to the Base Processes of the Scope Profile. An example of such mapping is shown in the table below

Base

the TickITplus Core Scheme Requirements and JTISC Working Group Member. With NPL being an early adopter of the TickITplus scheme, the briefing was invaluable to the authors and all delegates.

Awareness of the TickITplus scheme is also promoted through dedicated software quality pages on the NPL intranet and by induction presentations to new starters across all areas of the business.

3.6 Assessment

TickITplus requires that either external assessors examine projects for evidence of compliance (Exploration Mode) or staff from the organisation under audit be trained and registered as TickITplus practitioners [5]. Practitioners provide external assessors with evidence of compliance (Confirmation Mode).

The deadline for transition did not allow sufficient time for NPL staff to be trained as practitioners. Therefore to achieve transition the external assessors would review software development projects directly in Exploration Mode.

Stage 1 of the assessment commenced on 5th September 2014 with an examination of the Assessment Strategy, Process Reference Model and evidence of internal software quality audits carried out by the Corporate Assurance Team. The certification body assessor verified that the necessary documentation was in place and confirmed NPL's readiness for Stage 2.

Stage 2 commenced on 22nd September 2014 with an examination of a variety of software development projects. These projects included

Project Name	Description	Reference
MTDATA	Tool for calculation of thermodynamic properties. Used both within NPL and available externally.	[9]
TraCIM Computational Aims Database	A web-enabled database developed as part of the EU funded Traceability for Computationally Intensive Metrolo	

Processes. To satisfy compliance with the Organisation's Processes, evidence was collected through a series of interviews with members of NPL's Human Resources, Information Technology, Project Management and Corporate Assurance Teams.

Stage 2 concluded on 17 October 2014 with a recommendation by the certification body for transition to Tickplus. NPL received certification to Foundation level on 27 November 2014. As part of continual improvement, NPL's Corporate Assurance Team are reviewing the requirements for upgrading to Bronze.

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