CHAPTER 5

1. Automating the Test & Evaluation Process

1.1 Introduction

The automation of a process in general can be viewed as a formal method as described by Minkowitz (1993), which has been exploited successfully for computer systems development. Their use in the formulation of abstract and precise models of complex systems such as an F/A-18 aircraft, makes them ideally suited to system specification and design.

The use of formal methods as argued by Vadera & Meziane (1994) in the development of software has been advocated as a way of improving the reliability of software. A formal development life-cycle begins with a formal specification. Design steps such as those discussed in this chapter can then be proved with respect to their specification.

In actual fact the first step in the design process (Elliot, 1993) in which the broad route for all of the detailed work that follows is mapped out is merely a systems engineering progression. This means that it must take into account every aspect of the problem and every component of the solution and must consider their interactions, and not just their individual properties.

In search for a methodology to automate the T&E process, the author carried out a comprehensive literature search, as well as sending electronic mail and attending appropriate seminars and conferences, to determine whether this task had been tackled in the past, looking primarily at Australia and the United States. The outcome of this action is documented in the following section.

1.2 Previous Automation Efforts in Australia and the USA

As mentioned previously in chapter 2, research in the area of Test and Evaluation has been confined to defence related agencies, and influenced by the United States of America Department of Defence. According to the author’s knowledge, until now there has been no authentic published research related to the automation of Test and Evaluation Master Plans for defence acquisition test programs, except for that of a tool developed by the Science Applications International Corporation, more commonly addressed as SAIC, and funded by the Office of the Under Secretary of Defence for Acquisition and Technology/Director, Test, Systems Engineering & Evaluation (OUSD(A&T)/DTSE&E), as described by Roth (1995), in the United States of America, known as The Automated Test Planning System.

1.2.1 Automated Test Planning System

The Automated Test Planning System (ATPS) is a set of expert-system-based tools designed to aid in the test and evaluation oversight process. The tools are particularly well suited to staff members in the OUSD(A&T)/DT&E, and in the Department of Defence military service components. The current ATPS concept envisions four modules (Roth, 1995):

- Test and Evaluation Master Plan Review,
- Test and Evaluation Program Risk Assessment (TEPRAM),
- TEMP Build, and
- Test and Evaluation Program Design.

ATPS has been developed in close cooperation with the Test and Evaluation Community Network (TECNET). TECNET is a means of electronically exchanging unclassified information between Test and Evaluation practitioners since 1983 (Hurlburt, 1992). TECNET as well as ATPS release 4.5 for Windows® can be accessed and downloaded respectively, from the World-Wide Web (WWW) via the following Internet address; ***http*[1]*://atps.saic.com***. Phase I of the development process resulted in a systems-of-systems architecture as is shown in Figure 1-1, and a detailed system description.

[1] http stands for Hypertext Transfer Protocol (an Internet protocol)

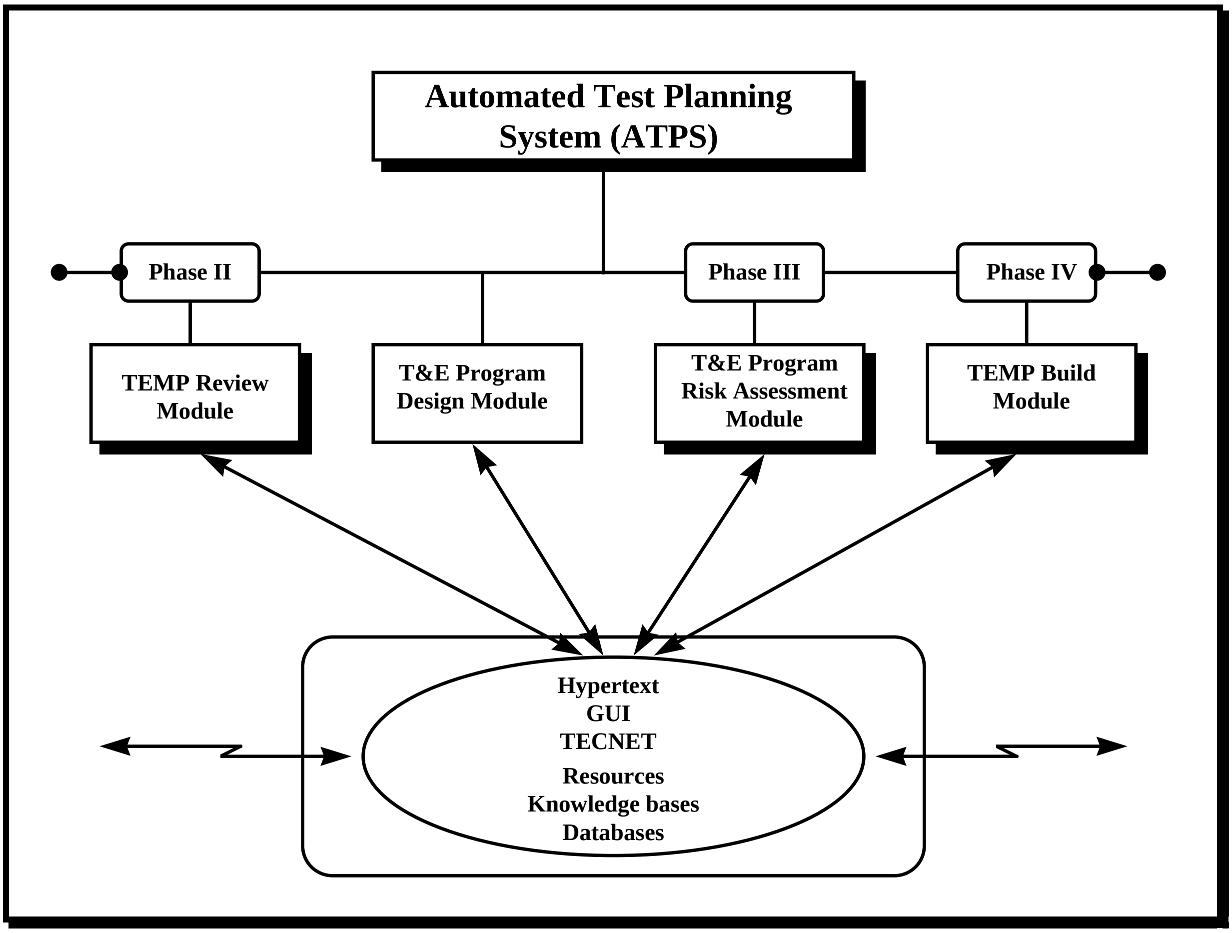

Figure 1-1 (A system-of-systems architecture of the Automated Test Planning System (Roth,1995))

The PC-based ATPS demonstrates the generation of an intelligent checklist for TEMP review. The body of knowledge was developed from representatives of United States DoD testing organisations, existing paper checklists (Okagaki and Helmuth, 1993). The software is based on the US DoD 500-series directives and instructions. In addition, the software accepts input by the user (TEMP review comments) and transfers those comments to an ASCII file, which can be read by a word processor for editing into a final report.

ATPS provides the user with a familiar Windows® (or Macintosh®) interface of buttons and menus to interact with its specialised rule bases, hypertext, advisor, editor, and file services (Roth, 1995). ATPS is a rule-based expert system (Okagaki and Ledesma, 1995) developed in Rule-extended Algorithmic Language (RAL), an extension of the C programming language, and encapsulates knowledge engineering and acquisition techniques, which are defined by Okagaki and Helmuth (1993) as follows:

> ***"Knowledge engineering** is based on conceptualising the portion of an experts knowledge that a computer program must emulate."*

> ***"Knowledge Acquisition**; The expert system consists of a knowledge base and a inference engine. The knowledge base contains a set of highly independent rules that link information concerning a problem to draw a conclusion. The inference engine controls the reasoning strategy of the system and suggests the action to be taken. The knowledge that is developed into rules is derived from facts and from information gained through experience or observation."*

ATPS is an analysis tool, designed to aid the human analyst, not to replace technical thought. It provides a standard baseline for TEMP development, risk assessment, and evaluation (Okagaki and Ledesma, 1995).

1.2.2 Review of Specriter 3© and AutoSpec©

Other more recent attempts to automate the generation of a process such as a plan, complying to military standards or specifications, using a computer aided approach have been the work of Cook (1991) and Evdokiou (1994), and the development of two software tools known as Specriter 3© and AutoSpec© respectively.

Cook (1991) developed a computer tool to assist in the production of measuring instrument specifications as part of his PhD entitled *"A Knowledge-Based System for Computer-Aided Generation of Measuring Instrument Specifications"*. The aim of this research was to produce a computer-assisted method of generating a measuring instrument requirements specification from a requirements analysis. Specriter 3© is a computer aided engineering package (Evdokiou, 1992) developed in Borland Prolog version 2.0, that employs knowledge representation techniques (Cook, 1990) to produce a specification for a measuring instrument, complying to US DoD MIL-STD-490A.

Evdokiou (1994) carried on the work by Cook (1991) with the development of a computer design tool to assist in the cognitive aspect of extracting requirement specifications for electronic systems, as part of his Masters Degree entitled *"Computer Aided Generation of Electronic Systems Requirements Specifications"*. The aim of this research was to conceptualise and develop a generic form of an electronic system such that descriptions of function, behaviour and structure are used in the formulation of a requirement specification template, and used as the basis for the subsequent automatic production of the initial requirements specifications documents (Evdokiou, 1994). AutoSpec© utilises Borland ObjectVision 2.1 for Windows® for extraction and storage of the requirements requested from the user, and Macros written in a document using Word 2.0 for Windows®, to automatically link the databases containing the requirements of the customer (Evdokiou, 1994) and generate a requirements specification document, complying to a type B1 USA MIL-STD-490A.

1.2.3 Review of T&E Plan Builder

The United States Army Operational Test & Evaluation Command (OPTEC), along with the University of Michigan has developed a similar type of automation software shell known as the Test & Evaluation Plan (TEP) Builder.

The TEP (Wyatt & Ward, 1996) is a prototype automated system developed to assist members of the Army T&E community in the key aspects of test planning such as the development of evaluation strategies, data requirements, and test designs. The TEP Builder is currently under construction and is being created to make OT&E both effective and affordable by producing consistently high-quality planning documents in less time.

Wyatt & Ward also state that the actual time required to produce test plans can be greatly reduced by eliminating redundant efforts. High-quality documents can be achieved by promoting document consistency, implement training, and managing quality.

1.3 The Need for Automation

In the past, in the Australian DoD, plans would be generated and products manufactured, systems developed, using the concepts, theories, and practices of T&E, and it has only been the last few years, more so since the birth of the Australian Centre for Test & Evaluation, that the Australian DoD and respective T&E community realised the importance of this process, and the importance to adhere to a master plan, a Test and Evaluation Master Plan (TEMP).

By regularly updating the TEMP from the genesis to the demise of a particular product/system, it would prove to be the most vital part of any defence acquisition test program, since it outlines strict critical issues, measures, and thresholds that all such test programs should adhere to. Only in this fashion can the efficiency be increased, and the cost and time of conducting tests be minimised, hence the need to automate the T&E process, namely, the TEMP, via the assistance of a computer has become apparent, and more so viable.

The next section will deal with the why and how requirements are needed to fulfill the need for automation, that is, the *why* and *how* of implementing requirements for the development of a Computer Software Configuration Item or CSCI..

1.4 Requirements for Software Implementation

The successful development of a large information system (Lalioti & Loucopoulos, 1994) is dependent on the use of a pertinent method for identifying the requirements on the target system and to make sure that the produced system will actually meet these requirements. Broadly, the first step in Requirements Engineering (RE), is the acquisition step, in which has the purpose of abstracting and conceptualising relevant parts of the application domain.

To begin with, one must first ascertain the requirements needed to automate the T&E process, the analysis of requirements (Johnson et al, 1993) is a difficult, often error-prone process because it relies on a wide range of domain and systems knowledge drawn from a variety of individuals and organisations.

Duke & Harrison (1995) state that formal approaches to software development have been mostly with problem descriptions that avoid expression of interactive behavior. However, rigorous software development emphasises the demonstration that a program correctly implements a specification, either through a process of verification or through the systematic derivation of programs from specification to valid refinement transformations.

Duke & Harrison go on to say that, refinement is therefore concerned with the construction of data structures and operations that are closer to the level of the machine that those in the original problem description.

For complex systems in the US DoD, there are certain standards that computer assisted systems should comply to, known as Computer-Aided Acquisition and Logistic Support or CALS compliancy. DoD MIL-HDBK-59B (1990) is the primary document for CALS. The primary goal of the CALS strategy is to migrate from manual, paper-intensive defence system operations to integrated, highly automated acquisition and support processes. The manual also states that effective implementation of the CALS strategy is achieved by addressing the following four elements throughout the life of a defence system:

1. Infrastructure for digital-based processes including computer hardware and software.
2. Process improvements in design, manufacturing and life cycle support.
3. Digital data acquisition.
4. Integrating technical data for use within weapon systems.

DeLauche and Reeves (1992) argue that the military services and DoD have developed specific, but different, road maps to get to the computer environment of tomorrow. Agendas differ relative to how CALS goals are reached. Surveys of the numerous automated support systems of today have resulted in a multitude of recommendations for a CALS-oriented support environment.

Within the US Armed Forces, a CALS Test Network (CTN) has been developed. The CTN (Lammers, 1992) is a logical network, that is, the emphasis is on a linkage between organisations to achieve objectives, rather than a physical telecommunications network. The objectives of the CTN are to:

- Develop distributed testing capability
- Demonstrate the complete data delivery process
- Evaluate the effectiveness of the CALS Standards
- Evaluate new technology

Poorly defined requirements are a sure recipe for disaster when software is involved. As described in IEEE STD 830-1984, characteristics of good software requirements are (Lacy, 1994) :

- Unambiguous
- Complete
- Verifiable
- Consistent

- Modifiable
- Traceable

1.4.1 Software Requirement Specification

Requirements for CSCI are often best described by a Software Requirement Specification, also known as an SRS in the software world. DoD Instruction DI-IPSC-81433 (1994) states that an SRS specifies the requirements for a CSCI and the methods to be used to ensure that each requirement has been met. This is a CALS compliant document and comprehensive guidelines for writing an SRS are contained within the Data Item Description or DID mentioned above.

An SRS for the CSCI AutoTEMP© Beta 2.0, comprising of the following CSCIs: T&E Information CSCI and Task Management CSCI, as described in Chapter 1 of this dissertation, has been compiled and sanctioned by Mark Dvorak of the ACTE, who is the ARC Collaborative Project Leader. The SRS is a fully endorsed eighteen page CALS compliant document, the details of which can be located in Appendix V, where a copy of the SRS is included in the Appendices section of this dissertation.

The SRS for the AutoTEMP© Beta 2.0 Software Shell[2] was developed as a voluntary addition, on the research work of the Flight Test Information Management System (FTIMS) Heuristic Transaction Shell (HTS), as per Chapter 1, and was also compiled to illustrate the natural progression of Software T&E documentation, the likes of which are as follows. The next progression from this document would have been the development of a System Design Description (SDD), had this been a software contract as opposed to a major research exercise.

Figure 1-2 illustrates this documentation process, that also acquires the purpose of representing a requirements traceability document. The diagram shows how and where the TEMP stands in this test documentation process, and was developed by the author to demonstrate the future direction of the traceability in software requirements.

[2] A tool developed by the author as a by-product of this research leading towards his Masters Degree.

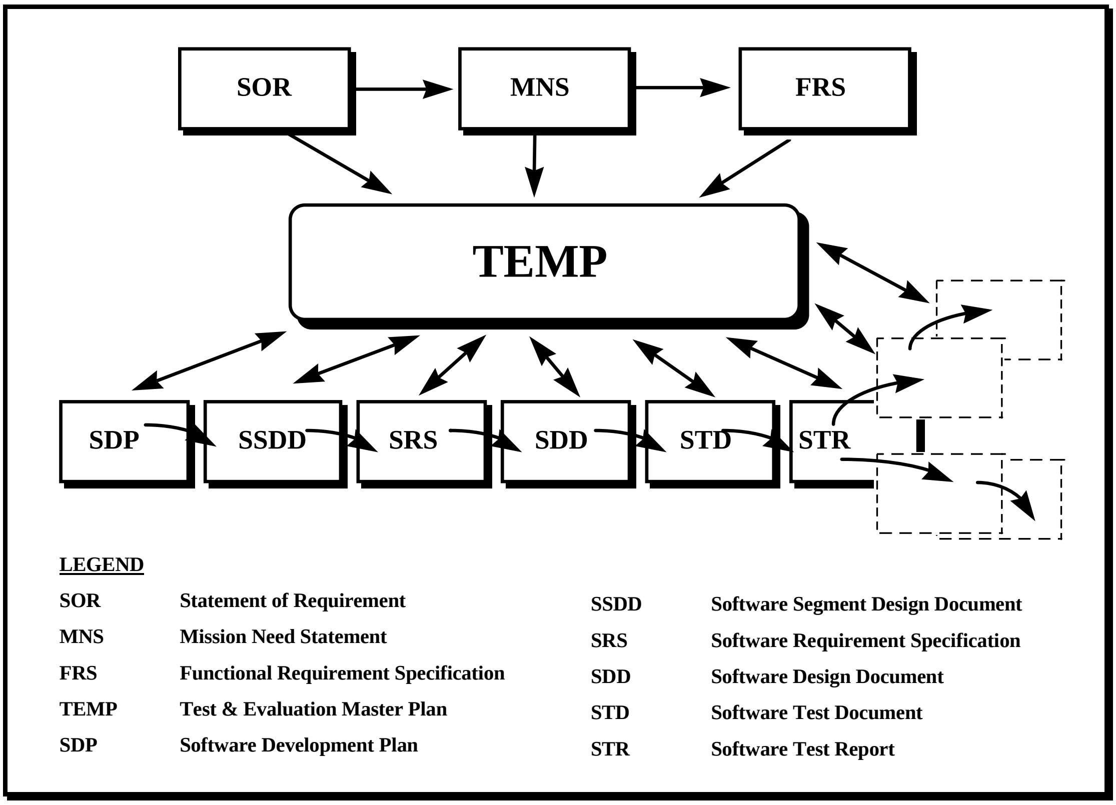

Figure 1-2 (Document Requirements Traceability Matrix)

As is evident from the diagram above, there is a lot of documentation for a particular system/product that is in the process of procurement, and this type of software T&E does not stop at any specific phase of the project, on the contrary, it continues right throughout the entire process, the TEMP is continually updated and hence requirements are somewhat “feedback” to the TEMP, for inclusion in the next update. A SSDD for the entire ARC Collaborative project has been developed by the Project Leader, Mark Dvorak of the ACTE, which outlines all four sub-research tasks as per chapter 1.

1.5 The Test & Evaluation Master Plan

1.5.1 Introduction

In this section a Test & Evaluation Master Plan (TEMP) will be defined, its role in the acquisition process, the US and Australian format will be presented and compared, and a generic version encapsulating the best parts of both formats, but primarily based on the Australian format will be defined and discussed comprehensively.

The United States has best described a TEMP for reasons mentioned previously in this dissertation. There are a number of US specific authors that have defined a TEMP and its format, namely, Rodriguez (1992), Przemieniecki (1993), DSMC (1993), DSMC (1995), Reynolds (1993), Reynolds & Damaan (1994), Dvorak and Equid (1994), and DoDI 5000.3-M-2 (1990).

1.5.2 What is a TEMP

Rodriguez (1992) defines a TEMP as an essential T&E document used by the Office of the Secretary of Defence (OSD) to support milestone decisions by the Defence Acquisition Board (DAB). The TEMP is the basic planning document for all T&E activity related to a particular system acquisition. It defines both DT&E and OT&E associated with system development and acquisition decisions. The TEMP relates program structure, decision milestones, test management structure, and required resources to critical operational issues, critical technical issues, evaluation criteria and procedures.

1.5.3 The Role of the TEMP

In the early 1980's, Reynolds (1993) states that the US DoD instituted the TEMP as the top level T&E planning document to be used in each "major" program, i.e., those that would come directly under the oversight of the Director of Operational T&E (DOT&E) and the Under Secretary of Defence for Acquisition, T&E (USD(A)(T&E)). The Services had adopted the use of the TEMP for lower level programs.

Dvorak and Equid (1994) states that the primary purpose of a TEMP is to establish a contract between the Project Manager (PM), the appropriate Australian Defence Force (ADF) decision maker, and the respective T&E agencies. The TEMP is essentially a living document that is updated prior to each milestone to report T&E progress completed and to provide a revised T&E plan for the next phase of activity. The TEMP is a multi-purpose document that:

- Enables the planning of test activities for demonstration of SPP's and TPP's,
- Details DT&E, PAT&E, and OT&E management structures and schedules,
- Provides a history of completed tests,
- Identifies critical performance parameters and operational issues,
- Provides a framework for generation of detailed test plans,
- Summarises required test resources, and
- Identifies new test resources.

For DoD programs where DT&E and OT&E are very distinct, the TEMP for each program combines both into an integrated master plan as is shown in Figure 1-3.

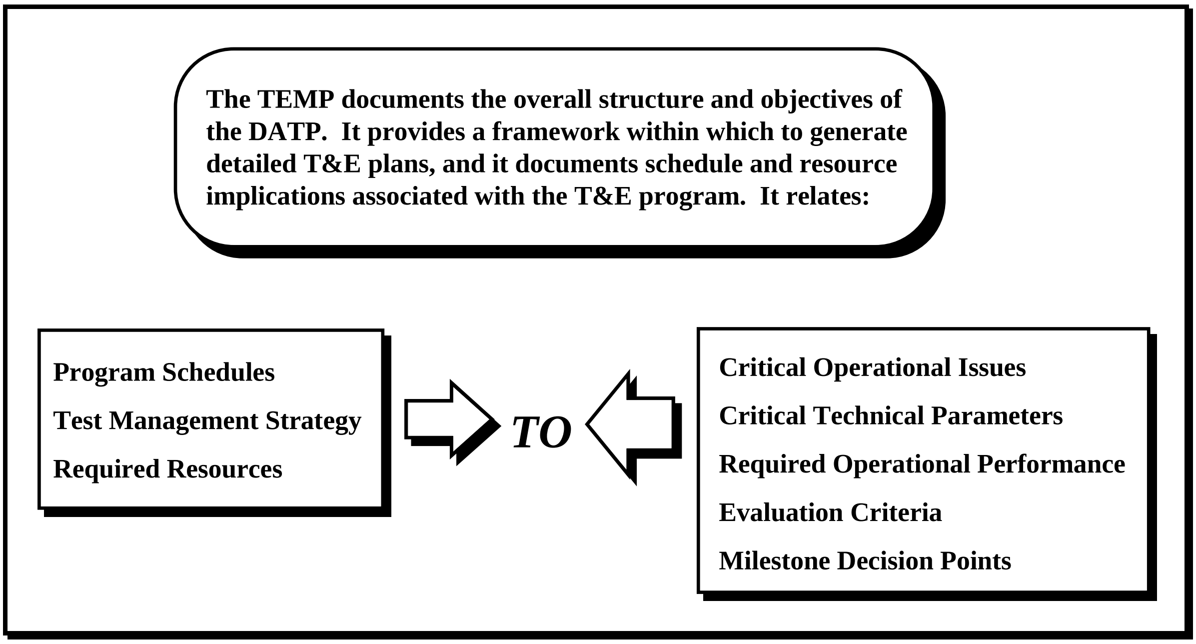

Figure 1-3 (Summary of the Purpose of a TEMP (based on Reynolds (1993))

The TEMP also documents a number of limitations in the DATP, more common types of limitations appearing in TEMP's are listed below (Reynolds & Damaan (1994):

- Cost
- Security Safety
- Ability to portray threat capabilities
- Ability to use full electromagnetic spectrum
- Test instrumentation
- Treaty constraints
- Available time
- Number and availability of test articles
- Test maneuver space
- Representative terrain
- Weather

1.5.4 Document Relationships

Figure 1-4 illustrates how the TEMP interrelates with other key program documents. In particular, the system performance requirements evolve from and expand upon those in the Operational Requirement Document (ORD), which result from threat analysis and Cost Effectiveness Analyses (CEA). This illustration is a merely an extension of Figure 1-2.

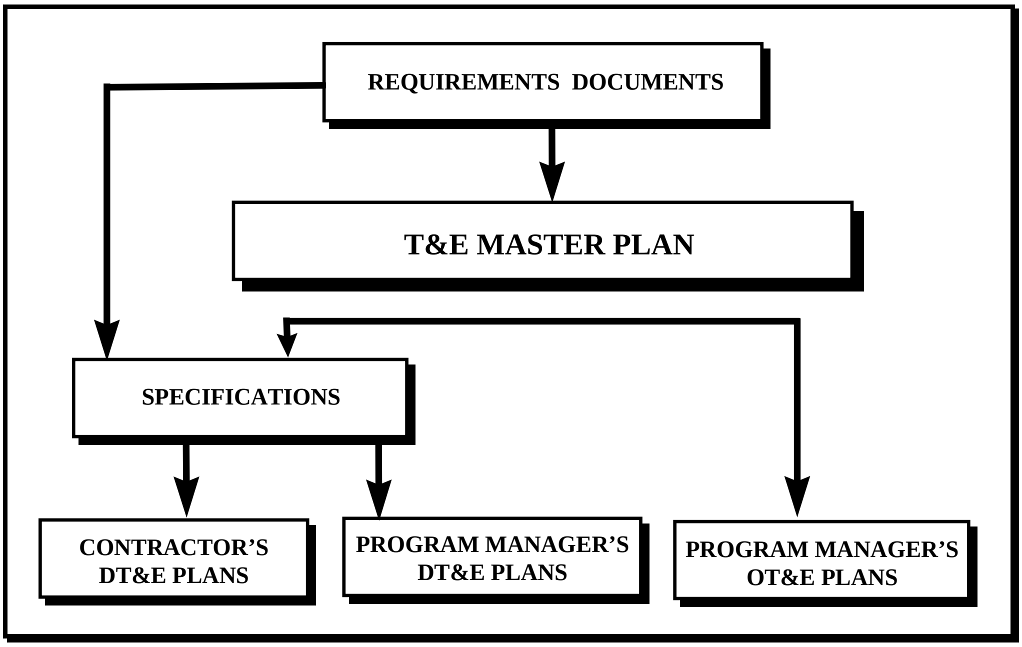

Figure 1-4 (TEMP Documentation Relationships (based on Reynolds (1993))

1.5.5 US TEMP Format

The United States was the first body to document a standard and format for generating a TEMP. This document was the Department of Defence Instruction 5000.3-M-1, first written in 1986 and then later updated in 1990, any further revisions are not known to the author's knowledge. The US TEMP format is shown in Figure 1-5.

The DSMC (1993) states that the TEMP is a living document that must address changes to critical issues associated with an DATP. Major changes in program requirements, schedule or funding usually result in a change in the test program. Thus, the TEMP must be reviewed and updated on program change, on baseline breach and before each milestone decision, to ensure that T&E requirements are current.

PART I	**SYSTEM INTRODUCTION (2 pages suggested)**
	Mission Description
	System Description
	Critical Technical Characteristics
	Required Operational Characteristics
PART II	**PROGRAM SUMMARY (2 pages suggested)**
	Integrated Schedule
	Management
PART III	**DT&E OUTLINE (10 pages suggested)**
	DT&E Overview
	DT&E to Date
	Future DT&E
	Special DT&E Topics
	LFT&E
PART IV	**OT&E Outline (10 pages suggested)**
	OT&E Overview
	Critical Operational Issues
	OT&E to Date
	Future OT&E
PART V	**T&E Resource Summary (6 pages suggested)**
	Summary
	Test Articles
	Test Sites and Instrumentation
	Test Support Equipment
	Threat Systems/Simulators
	Test Targets and Expendables
	Operational Force Test Support
	Simulations, Models and Testbeds
	Special Requirements
	T&E Funding Requirements
	Manpower/Training
	Key Resources
APPENDIX A	**BIBLIOGRAPHY**
APPENDIX B	**ACRONYMS**
APPENDIX C	**POINTS OF CONTACT**

Figure 1-5 (US TEMP Format (adopted from DoD 5000.3-M-1))

1.5.6 The Australian TEMP Format

In the Australian Defence Force, the underlying document that provides any related T&E guidance is the Capital Equipment Procurement Manual (CEPMAN 1) (Australian DoD, 1995), which outlines the conduct of test & evaluation in support of capital equipment projects.

Chapter 14, part 2, of this manual contains a brief overview of the requirements for the planning and conduct of test and evaluation to be performed by defence during projects in order to obtain factual data to assist in validating new or upgraded equipment. The manual states that organisations with responsibility for the design approval, certification or procurement of equipment have the authority and responsibility to conduct (or require the conduct of) T&E. All project T&E requirements are to be coordinated by the project manager, who should consider whether or not T&E can be conducted within available project resources and if it is preferable to seek assistance of an external agency to conduct or assist in conducting such T&E.

The manual also states that project manager, in consultation with operational, technical and maintenance authorities, is to fully investigate the necessity for, and likely scope of, Defence T&E. If a requirement exists for the conduct of T&E, its scope is to be documented in a Test & Evaluation Master Plan (TEMP) at the earliest possible stage in the project planning process. Annex B of the manual, details the role, content and format of a TEMP, and TEMP writer's guide is in Annex C.

A description of the Australian TEMP format is detailed in the author's software AutoTEMP©, beta version 2.0, in the form of a hypertext interactive software tutorial. This tutorial is the first of three software modules that make up AutoTEMP© and its hypertextability and human-computer interactivity as well as a detailed description is dealt with in more detail in chapter 6. For this reason, the proceeding description will merely give an outline of the TEMP format, and any detail that is not dealt with in the tutorial. The generic table of contents is shown in Figure 1-6.

1. SECTION I - DESCRIPTION

1.1. MISSION
1.1.1. Operational Need
1.1.2. Mission to be accomplished
1.1.3. Specified Environment
1.2. SYSTEM
1.2.1. Key Functions
1.2.2. Interfaces
1.2.3. Unique Characteristics
1.3. REQUIRED OPERATIONAL CHARACTERISTICS
1.3.1. Key Operational Effectiveness Characteristics
1.3.2. Key Suitability Characteristics
1.3.3. Thresholds
1.4. REQUIRED TECHNICAL CHARACTERISTICS
1.4.1. Key Technical Characteristics
1.4.2. Performance Objectives
1.4.3. Thresholds
1.5. CRITICAL T&E ISSUES
1.5.1. DT&E Critical Issues
1.5.2. OT&E Critical Issues
1.5.3. S3 Critical Issues

2. SECTION II - PROGRAM SUMMARY

2.1. MANAGEMENT ASPECTS
2.2. INTEGRATED SCHEDULE
2.3. FUNDING ASPECTS OF THE T&E PROCESS

3. SECTION III - DT&E OUTLINE

3.1. DT&E TO DATE
3.1.1. Summary of DT&E already Conducted
3.1.2. Difference for Plan
3.1.3. DT&E Events and Results
3.2. FUTURE DT&E
3.2.1. Equipment Description
3.2.2. DT&E Objectives
3.2.3. Limitations of Scope
3.2.4. Test Failure Procedures
3.3. CRITICAL DT&E ITEMS
3.3.1. Equipment Used

4. SECTION IV - OT&E OUTLINE

4.1. OT&E TO DATE
4.1.1. Summary of OT&E Date
4.1.2. Test Schedules
4.1.3. OT&E Events and Results
4.2. FUTURE OT&E
4.2.1. Equipment Description
4.2.2. OT&E Objectives
4.2.3. OT&E Events/Scope of Testing/Basic Scenarios
4.3. CRITICAL OT&E ITEMS
4.3.1. Highlights

5. SECTION V - PRODUCTION ACCEPTANCE T&E (PAT&E)

5.1. PAT&E TO DATE
5.1.1. Summary of PAT&E to Date
5.1.2. Test Schedules

5.1.3. PAT&E Events and Results
5.2. FUTURE PAT&E
5.2.1. Equipment Description
5.2.2. PAT&E Objectives
5.2.3. PAT&E Events/Scope of Testing
5.3. CRITICAL PAT&E ITEMS
5.3.1. Highlights

6. SECTION VI - SAFETY AND SUITABILITY FOR SERVICE (S3)

6.1. FEATURES
6.2. EQUIPMENT
6.3. SYSTEMS SAFETY PROGRAM
6.4. S3 EVALUATION
6.4.1. Descriptive Proceeding
6.4.2. A Laying-on Proceeding
6.4.3. A Reporting Proceeding

7. SECTION VII - SPECIAL RESOURCE SUMMARY

7.1. TEST SCHEDULES
7.2. INSTRUMENTATION
7.2.1. Targets
7.2.2. Threat Simulations
7.2.3. Test Sites
7.2.4. Facilities
7.2.5. Support

8. APPENDIX A - POINTS OF CONTACT

9. APPENDIX B - NOMENCLATURE

10. APPENDIX C - REFERENCED DOCUMENTS

Figure 1-6 (CEPMAN 1 TEMP Format (based on Australian DoD, 1995))

1.5.7 Comparison of US and Australian TEMP Format

Table 1-1 summarises the difference between the US DoD 5000.3-M-1 and the Australian DoD CEPMAN 1 TEMP format. As is evident the US format does not detail PAT&E and Systems, Safety and Service (S3) as the Australian format does.

US DoD 5000.3-M-1	AUSTRALIAN DoD CEPMAN 1
Part I - System Introduction	Section I - Description
Part II - Program Summary	Section II - Program Summary
Part III - DT&E Outline	Section III - DT&E Outline
Part IV - OT&E Outline	Section IV - OT&E Outline
	Section V - PAT&E Summary
	Section VI - S3 Evaluation
Part V - T&E Resource Summary	Section VII - Special Resource Summary
Appendix A - Bibliography	Appendix A - Bibliography
Appendix B - Acronyms	Appendix B - Acronyms
Appendix C - Point of Contact	Appendix C - Point of Contact
	Appendix D - User Information Matrix

Table 1-1 (The US DoD 5000.3-M-1 and Australian DoD CEPMAN 1 TEMP Format Compared)

The US denotes the sections of the TEMP with the terminology “Parts”, and the Australia has adopted “Sections”, of which there are five and seven respectively. The PAT&E and S3 sections are excluded. PAT&E is considered an element of DT&E in the US system. The S3 functions are examined by both the OT and DT communities.

1.5.8 Australian Conceptual TEMP Format

As mentioned previously, the author has conceptualised a generic format of the TEMP contents, which is primarily based on CEPMAN 1 but with modifications and additions with the help of the US TEMP format and other literature mentioned in section 5.5.1 previously. This conceptualisation is depicted in Figure 1-7 overpage.

1. SECTION I - DESCRIPTION

1.1 DOCUMENT DESCRIPTION
1.2 MISSION DESCRIPTION
1.2.1 Operational Need
1.2.2 Mission to be accomplished
1.2.3 Specified Environment
1.3 SYSTEM DESCRIPTION
1.3.1 Key Functions
1.3.2 Interfaces
1.3.3 Unique Characteristics
1.4 REQUIRED OPERATIONAL CHARACTERISTICS
1.4.1 Key Operational Effectiveness Characteristics
1.4.2 Key Suitability Characteristics
1.4.3 Thresholds
1.5 REQUIRED TECHNICAL CHARACTERISTICS
1.5.1 Key Technical Characteristics
1.5.2 Performance Objectives
1.5.3 Thresholds
1.6 CRITICAL T&E ISSUES
1.6.1 DT&E Critical Issues
1.6.2 OT&E Critical Issues
1.6.3 S3 Critical Issues

2. SECTION II - PROGRAM SUMMARY

2.1 MANAGEMENT ASPECTS
2.2 INTEGRATED SCHEDULE
2.3 FUNDING ASPECTS OF THE T&E PROCESS

3. SECTION III - DT&E OUTLINE

3.1 DT&E TO DATE
3.1.1 Summary of DT&E already Conducted
3.1.2 Difference for Plan
3.1.3 DT&E Events and Results
3.2 FUTURE DT&E
3.2.1 DT-I
3.2.1.1 Configuration Description
3.2.1.2 DT&E Objectives
3.2.1.3 DT&E Events
3.2.1.4 Limitations to Scope
3.2.2 DT-II TECHEVAL
3.2.2.1 Configuration Description
3.2.2.2 DT&E Objectives
3.2.2.3 DT&E Events
3.2.2.4 Limitations to Scope
3.2.3 Test Failure Procedures
3.3 CRITICAL DT&E ITEMS
3.3.1 Equipment Used

4. SECTION IV - OT&E OUTLINE

4.1 OT&E TO DATE
4.1.1 OT-I EOA
4.1.2 OT-II OPEVAL
4.1.3 Summary of OT&E Date
4.1.4 Test Schedules
4.1.5 OT&E Events and Results
4.2 FUTURE OT&E
4.2.1 OT-I EOA

4.2.1.1 Configuration Description
4.2.1.2 OT&E Objectives
4.2.1.3 OT&E Events
4.2.1.4 Limitations to Scope
4.2.2 OT-II OPEVAL
4.2.2.1 Configuration Description
4.2.2.2 OT&E Objectives
4.2.2.3 OT&E Events
4.2.2.3.1 Scenarios
4.2.2.4 Limitations to Scope
4.2.3 OT-III FOT&E
4.2.3.1 Configuration Description
4.2.3.2 OT&E Objectives
4.2.3.3 OT&E Events
4.2.3.4 Limitations to Scope
4.3 CRITICAL OT&E ITEMS
4.3.1 Effectiveness Issues
4.3.1.1 Document Generation
4.3.1.2 Traceability
4.3.1.3 Future Growth
4.3.2 Suitability Issues
4.3.2.1 Availability
4.3.2.2 Compatibility
4.3.2.3 Transportability
4.3.2.4 Interoperability
4.3.2.5 Reliability
4.3.2.6 Wartime Usage Rates
4.3.2.7 Maintainability
4.3.2.8 Safety
4.3.2.9 Human Factors
4.3.2.10 Manpower Supportability
4.3.2.11 Logistics Supportability
4.3.2.12 Documentation
4.3.2.13 Training Requirements
4.3.3 Highlights

5. SECTION V - PRODUCTION ACCEPTANCE T&E (PAT&E)

5.1 PAT&E TO DATE
5.1.1 Summary of PAT&E to Date
5.1.2 Test Schedules
5.1.3 PAT&E Events and Results
5.2 FUTURE PAT&E
5.2.1 Equipment Description
5.2.2 PAT&E Objectives
5.2.3 PAT&E Events/Scope of Testing
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6. SECTION VI - SAFETY AND SUITABILITY FOR SERVICE (S3)

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8. APPENDIX A

8.1 POINTS OF CONTACT

9. APPENDIX B

9.1 NOMENCLATURE

10. APPENDIX C

10.1 REFERENCED DOCUMENTS

11. APPENDIX D

11.1 USER INFORMATION MATRIX

Figure 1-7 (Conceptualised TEMP Format (adopted from AutoTEMP© Beta 2.0))

Due to the size of the TEMP as is evident in Figure 1-7, it was more appropriate to give a detailed description of the TEMP format specified in Figure 1-7 as an attachment to this dissertation, which is located in Appendix VI. The description makes use of both the US DoD 5000.3-M-1 (1990) and the Australian DoD CEPMAN 1 (1995), as well as other sources annotated in the Appendix.

1.5.9 Summary

The Australian DoD (1995) CEPMAN 1 states that in summarising, the TEMP is a living resource document used by various agencies who often have differing T&E priorities. Updates are made prior to each milestone to ensure the document reflects the evolving system. Agencies can also make incremental changes as required to ensure the TEMP is aligned with current T&E objectives.

CEPMAN 1 also states that historically ADF TEMPs were written to identify T&E requirements only until a specific system reaches production. Recent policy changes have required the life of the TEMP to extend to the entire service life of the system (similar to US method). These changes were initiated for coordination of T&E in support of in-service system upgrades and future stores/weapons system integration.

1.6 Human-Computer Collaboration

In carrying out the action of automating any process one must certainly consider the consequences of the user and advantages or perhaps disadvantages that this action could impose. Terveen (1995) defines Collaboration as *"a process in which two or more agents work together to achieve shared goals"*. Terveen also states that the study of Human-Computer Collaboration (HCC) is highly disciplinary. Its two basic parent disciplines are Artificial Intelligence (AI) and Human-Computer Interaction (HCI). AI draws knowledge representation and reasoning techniques, and HCI draws interaction and information presentation techniques.

Rogers (1995) states that the enhancement of human performance in complex tasks is an issue which has long concerned researchers, particularly with respect to the role of automation. He goes on to say that, in order to build effective human-machine cognitive systems, techniques and concepts are needed to identify the decision-making/problem-solving requirements in some domain.

The US Army on the other hand, states that (Banister, 1995) the materiel acquisition process is replete with procedures, processes, and policies designed to eliminate or reduce the uncontrollable human variable in all phases of the weapons system acquisition process, defined in chapter 4. Both disciplines however, Software Engineering (SE) and HCI need ways of measuring how well their products and development processes fulfill their intended requirements, as argued by Preece & Rombach (1994).

Bishop (1994) states that the OPTEC has provided its operational evaluators and analysts to assess the user friendliness of computer software with the development of a guide known as "Handbook for the Evaluation of User Friendliness of Soldier-System Interfaces", in which its goal in life is "to quantify system user friendliness across the full range of subjective and objective data obtained from users, and others, who are familiar with a given system."

Thus, the author has designed the software shell AutoTEMP©, that is described in the proceeding chapter, used to assist the user (human) in generating a TEMP, so that there is some degree of user-computer friendly interaction. This consideration merely adds more thorough software T&E of the system at hand, and hence an increase in efficiency, and reliability.

1.7 Conclusion

This chapter has looked at the automation of the T&E process, in which a review of previous work such as, The Automated Test Planning System, Specriter 3©, and AutoSpec©, by the Science Applications International Corporation, Cook (1991) and Evdokiou (1994) respectively, was discussed, along with the need for and requirements for its automation.

The importance of adhering to and regularly updating a TEMP was emphasised as the most vital part of any defence acquisition test program, due to the fact that it outlines very crucial elements and parameters that all such test should aspire to, and only in this fashion can the cost and time of conducting a test be reduced and efficiency subsequently increased, via the assistance of a computer in automating this process.

The chapter then concluded with a comprehensive discussion of TEMP's, outlining the formats used by the United States and Australia, its role, and its conceptualisation into a generic form or template, along with a brief discussion on the collaboration between the software and the user operating it.

The next chapter will give an insight into the by-product of this research, namely, a detailed look at AutoTEMP© Beta 2.0, and its operation, via a breakdown of its three interlaced modules.