CHAPTER 7

1. Conclusions and Future Proposals

1.1 Conclusions

This thesis described the author's research contribution and findings on the collaborative project, involving both the ACTE and the ARDU of the RAAF, which was to conduct research which would "assist in the design of telemetry data formats and contribute to assuring end-to-end data traceability of test programs" as stated by ARDU (1993). Among the four primary areas of interest mentioned in chapter 1, was the primary focus of the author's research, an attempt to conceptualise and thus automate via the assistance of a computer, the manual generation of Test & Evaluation Master Plans, for the real-time test & evaluation of complex systems, such as the highly instrumented fighter aircraft F/A-18 Hornet of the RAAF, from the functional requirements specification of any defence acquisition test program. The TEMP document produced by the by-product of this research, namely, a non-commercial piece of software known as AutoTEMP© Beta 2.0, was designed to comply with the Australian Defence Force Capital Equipment Procurement Manual, often referred to as the CEPMAN 1, instruction.

Chapter 2 gave a comprehensive overview of the genesis of test & evaluation, and hypothesised that T&E is essentially a process and synonymous to the systems engineering process, not to mention merely a natural progression of the traditional scientific method, and is the phrase implies, a two part process. The test which involves the planning and execution of an experiment in an effort to collect data, whilst evaluation is the assessment of this data, against a known standard, in an approach to obtain some knowledge regarding the quality of the subject under test.

Chapter 3 outlined a genealogy of the discipline of this research, namely, aircraft flight test. It was determined that the T&E practitioners were taking more measurements and raw

data than they could simply cope with, and as a consequence increased the cost of testing not to mention manpower and equipment required to carry out these tests, hence it was imperative to keep tests simple, small, economical and manageable, i.e., comply to the philosophy of parsimony. In order to assist in the design of telemetry data formats, a brief outline to telemetry formats used in flight testing was also discussed.

Chapter 4 analysed and compared the United States of America and Australian T&E structures and processes that these countries follow. The reason for only looking at the United States Department of Defence and not other countries, was solely because it is the best documented T&E system in the world, and because of this fact, many non-US based countries have the tendency of adopting its basic principles, terminology, and structure.

Chapter 5 gave a concise description on the research methodology utilised in the attempt to conceptualise and automate the Australian T&E process. It was concluded that the last few years, in particular since the birth of the Australian Centre for Test & Evaluation, that the Australian Department of Defence and respective T&E community realised the importance of the entirety of this process, and the immense importance to adhere to a Test & Evaluation Master Plan. It was further determined that only by regular updates of the TEMP, i.e., from the genesis to the actual demise of the particular product/system, would it prove to be the most vital part of any defence acquisition test program, considering it outlines strict critical issues, measures, and thresholds that all such test programs must follow.

Chapter 6, the penultimate chapter in this dissertation gave a concise description of the by-product of this research, namely, AutoTEMP© Beta 2.0, outlining descriptions of all three modules, i.e., the US defence phased acquisition process tutorial, the TEMP generation module, and the automatic generation of the TEMP document, Autotemp.doc, along with a summary of the lessons learnt from sample tests, and the final quality of the TEMP document as compared to other attempts in the past.

AutoTEMP© is the result of a two and a half year research program at the Australian Centre for Test & Evaluation of the University of South Australia. This research has accomplished its objectives in conceptualising and automating the manual generation of TEMP's for any defence acquisition test program.

In conclusion, this research has contributed to the T&E process in the way of immediate benefit to ARDU, and a spin off value to other Australian agencies faced with test and evaluation problems on a similar scale. In particular, those agencies involved with aircraft, ships, submarines, large modeling and simulation tasks, command, control, and communication (C^3I) systems, air traffic control systems, and space related activities. More specifically, this research has contributed to the perfection of the T&E process via views of T&E in the future, which are prospects of a paperless test and evaluation process.

1.2 Further Research

AutoTEMP© Beta 2.0 breaks new ground in the preparation of TEMPs for DATPs. There are, inevitably, an ensemble of areas which can be developed to a higher calibre. AutoTEMP© Beta 2.0 is now well advanced, and has been moulded to a stage where it can be commercialised for use in the many defence sectors around the world, those of which are mentioned in Chapter 1. Possible avenues are the prospects of using AutoTEMP© on the Internet. A very brief overview of the Internet is given in the section.

1.2.1 Access and Use of AutoTemp© Beta 2.0 on the Internet

1.2.1.1 Introduction to the Internet

As it stands today the most prominent need would be to make this information accessible to the rest of the world, much like on the Information Superhighway, more commonly known as the *Internet*. There is ample information on the Internet to learn from, and probably more then one would need, and be somewhat overwhelmed with knowledge, from what is the Internet, to creating your own home pages using the Internet's own language known as Hypertext Text Mark-Up Language or HTML.

In order to make this information accessible to the rest of the world, entails invoking the software onto a World Wide Web server such as the one created by the Centre for University Teaching and Learning or CUTL at the University of South Australia. The World Wide Web, or WWW, is the newest information service to arrive on the Internet. The Web is based on a technology called *hypertext,* defined in chapter 6. To try the Web, all you need to do is telnet to it. This will automatically drop you into a public-access client program or *browser*, to use the Web's technology. There are several browsers available on the market today, most of which can be directly downloaded from the Internet itself. The most advanced browser

available is called Netscape. It works on UNIX under the X Windows system (where its called xnetscape), the Macintosh, and Microsoft® Windows (Krol, 1992).

The ACTE has created it's own WWW server with information pertaining to the centre, it's structure, people, and so forth. The address of which can be invoked using a protocol more commonly known as Hyper Text Transfer Protocol or HTTP address, namely, ***http://www.acte.unisa.edu.au***.

In this fashion we create an electronically accessible Automated TEMP generator. As well as having the Knowledge Based Software System resident on the Internet the author envisages that one could also add to this "Knowledge Base" via access to the following information :

- A Test & Evaluation Bibliography Database.
- Digitised pictures/diagrams (aircraft in flight, flow diagrams, etc.,)
- A database of T&E definitions.
- National and Global access to information and or other databases (such as *TECNET)*

1.2.2 Extensions to the TEMP Format & Hardware Domain

Another possible suggestion is to extend the Knowledge Base, and have AutoTEMP© Beta 2.0, automatically generate TEMPs according to other TEMP formats, for instance, the US DoD 5000.3-M-1 instruction, or other unique TEMP formats, hence allowing the user to have the ability to choose the format that the TEMP must follow, and not fixed to that of the ADF CEPMAN 1 instruction. Needless to say, the software has the ability to grow and be modified with ease. The improvements are limited only by the programmers imagination, or specifications for that matter, but more likely by the application domain it is used in.

Extending the hardware domain to other platforms such as Unix and Macintosh is also another possible and legitimate extension to the software, more so Unix, as this would allow large Main Frame Computers that are based on this technology to access the information more readily.

1.2.3 PhD Research Extension

This research was intended to lead to a Masters Degree, however it is envisaged that there is great potential based on the complexity and size of the associated area of interest, that there

could be prospects of the program being extended to a Doctoral level. The need for carrying out this research is, currently in the DoD and subsequent defence departments there is more rigorous testing and evaluation, and thus V&V of these tests. However these processes are not well documented, far from universal, and usually carried out by a highly trained person that has experience in fields such as DT&E and OT&E. A generic *T&E Process Document Traceability and Cognition Software System* would be great importance to the global defence sector as a support tool in which mature methodology could be embedded (Nissyrios, 1995c).