# 1. Executive Summary

TTP Meteor Ltd is part of the Technology Partnership Group, a technology development and innovation centre, located in the Melbourne Science Park near Cambridge. The Technology Partnership was created 25 years ago and now the enterprise has grown and evolved into TTP Group, where a range of technical and businesses take place. TTP Group provides a broad range of product and service in various market sectors, covering medical devices, aerospace and defence, communications, digital printing, etc. New companies are created inside the group and TTP Meteor Ltd is one of them.

TTP Meteor is specialised in providing powerful and flexible driver solutions for industrial printheads. Today’s industrial-used printheads are demanding and sophisticated devices, with high requirements on precision, quality, print speed and scale, which affects the quality and efficiency of manufacturing process. Different printheads electronics and software must be optimised to achieve best performance. TTP Meteor provides a flexible but powerful architecture, associating various printheads to Meteor PrintEngine Software, which can be re-configured simply to meet the changing and evolving environment in printing market, including ceramics, textiles, wide format, labelling and digital press.

My project in TTP Meteor is about finding a better method to monitor the operation of hardware components, including the hardware code into the regression test process. The fast-changing customer demand lead to a frequent upgrading in Meteor solutions while modifications in existing Meteor architecture may bring unforeseen outcomes to some specific types of printheads. Current regression test procedure for hardware components is actual printing on rig. This is a time-consuming process and usually a cumbersome job when number of target hardware increases. By pseudo printing specific test pattern, collecting and analysing necessary signals from hardware using software, testing procedure will be simplified with potentially higher accuracy, bringing higher working efficiency into company operation.

Apart from the main project about hardware testing as mentioned above, I was also involved in other project and allocated other jobs. Technical projects include developing testboards, which performs quick check of manufacture errors before mass production. On the business side, I was responsible to provide customer support for those from non-English speaking countries, realising the direct communication between the engineers at both sides.

This placement project is closely related to my college course content and requires me to apply and develop my knowledge in practical situations. In the placement, I had the opportunity to broaden my skill set by learning and practicing PCB design, FPGA development and windows application development, and hence, find my interest in some particular engineering work. TTP Meteor is growing at an incredible speed in the past few years. The business strategies this company is following, which explored the new market and contributed to the independency of TTP Meteor is also impressive. This placement not only practiced my technical skills, but also provided me with a broader view about company management and business operation.

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# 2. Company Overview

TTP Group is a world-leading technology and development company, focusing on meeting needs of companies through the use of advanced technology and innovations. It is located in a Science Part near Cambridge. The main business in TTP Group is technical consulting, providing ideas and designing solutions to clients. It has been playing a pioneering role in a broad range of areas including drug discovery, pharmaceutical automation, laboratory instrumentation, digital printing, wireless communications and consumer products.

Twenty-five years ago, the Technology Partnership was established, which quickly expanded and reorganised under the new parent, TTP Group plc. As the business has grown, new companies have been created and flourished. Now TTP Group has more than three hundreds technical consultants and scientists, working in several independent enterprises within the group, such as TTP Labtech, TTP Venture Fund, etc.

TTP Meteor was born with TTP, closely involved in digital printing for decades, and has officially become an independent company this year, specialised in providing industrial-used printhead driver systems. TTP Meteor is not only limited in consulting business, but also including hardware production and customer support into the business. Apart from providing designs and prototyping solutions, Meteor also offers its own software and hardware architecture which is applicable to twenty different print head in market. This strategy contributes to the revenue increase of 80% every year in the past few years and transfer TTP Meteor from a consulting group to an independent company. Now it has fourteen engineers and consultants, and a number of salesmen based in Europe, Asian and America.

//Add introduction to printing industry, difference between industries used printers and commercial-used printers. Why this company survives

Meanwhile, the Meteor hardware and software are optimised differently to achieve the best performance out of different printhead.

I came to TTP Meteor as a member of the research and development team. TTP Meteor organises monthly company business meeting, showing the operation and situation of the company, such as monthly revenue report, customer demand and human resource. In addition, research and development team has weekly meeting, discussing the progress and working plan of individuals as well as the team.

Meteor

Role and responsibility

The company operation developed my understanding in business and management.

Through working closely with customers and participating conference, I also improved my skills in interacting with different customers.

TTP Meteor is now growing in a rapid speed with more than one hundred percent increase in revenue last year. The intensive individual responsibility in this small company makes the job allocation clear. How employees with different responsibility coordinate together and guide the company forward is a fascinating process to experience and witness.

# 3. Project Description and Reflection

The project I was responsible for during this placement is developing a procedure which inspects and analyses hardware operations, including hardware components into the regression test procedure. Before explaining any details, an overview of the typical design architecture, ‘the Meteor Architecture’, will be helpful in acknowledging the aim and working principles of this project.

## 3.1 Project Background

TTP Meteor has its origin in consulting industry, which is famous for fierce competition and changeable environment. To satisfy the fast-changing demand from customers, Meteor developed its own architecture, providing a highly flexible and adaptive solution for printhead driver systems. By using the Meteor Architecture, users are able to select or switch their printhead options among the twenty supported printheads, with low cost, to maximise their benefit.

**User Input**

**Windows Application**

**Print Controller Card**

**Head Driver Card**

**Head Driver Card**

**… …**

**Print Head**

**Print Head**

**… …**

Windows Application:

User interface and command control

Print Controller Card (PCC):

Central hardware control unit

Head Driver Card (HDC):

Driver unit for different printheads

**Figure 1.** The Typical Meteor Hardware Architecture (In blue area).

Figure 1 illustrates the basic Meteor Hardware Architecture, which realised the complete user control over multiple printheads. The Meteor Architecture consists of three major components: software application, print controller card (PCC) and head driver card (HDC).

Software application is the user interface, which provides complete user control over configurations, offering various printing choices for different practical situations. The fast image transmission allows the high printing speed of printhead, which is the basis of high productivity in printing industry.

Print Controller Card (PCC) is the control hub, distributing image data and command to multiple head drivers. It coordinates multiple head drivers to accomplish a more complicated printing job, for instance, printing in seamless and large scale, or printing with a resolution, which is higher than that of the printhead.

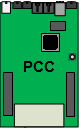
Head Driver Card (HDC) is the hardware designed to achieve the best performance out of print head. Twenty different types of printheads are supported with specialised HDCs, providing a range of choices for customer. Each type of HDC is optimised in different ways depending on printhead choice. For instance, different printheads require different waveform across the piezoelectric material to fire ink drop. Also some ink type desires suitable operation temperature or UV light to obtain the best performance.

However, high flexibility and adaptability of this architecture introduces risk in reliability. Fast-changing environment requires Meteor to upgrade or modify our design, both software and hardware, frequently to satisfy customer’s changeable demand. It brings the challenge that the any revision or upgrade performed may or may not support all print head types since they are usually designed for customer with specific printhead preference. Therefore, to ensure the change on part of the architecture does not damage the rest, a regression test procedure is necessary.

Due to the limitation on time, equipment and human resource, it will be cumbersome and impractical to perform actual printing with all supported printheads in the company. This brings in the motivation of my project. By inspecting all necessary signals at hardware output, sufficient information can be collected to distinguish a ‘good’ or ‘bad’ printing behaviour. This test procedure is universal and applicable to all printheads. The Meteor Architecture will be examined on computer so this test does not require actual connection to printhead or ink system, and therefore expected to be simple and convenient. //Need further simplification

## 3.2 Project Description

The intuition of this project is to perform universal regression test on the Meteor Architecture, by inspecting hardware outputs, which shall be collected and analysed in software. The test procedure design is further divided into three major questions: How to collect data from various types of printhead in order to keep the testing procedure universal? How to transfer collected data back to computer in a reliable way at a reasonable speed? How to perform reliable analysis and distinguish correct and faulty signals for different signal types? Solutions to these questions constitute the blueprint of my design.



## 3.2.1 Technical Overview

## 3.2.2

## 3.2.3

## 3.2.4

## 3.2.5

## 3.3 Project Refection

Challenge,

Personal and Professional lessons

Future work

Relevance to degree course

Thinking and Planning of future career

# 4. Conclusion