1. **Detailed design of manufacturing equipment suitable for process micro-scale component features.**

The manufacturing sector in NZ has supported the growth of the country since the early days through the primary industries that helped build our infrastructure and reputation. More recently the country has become known as a seed hub for advanced technologies and innovative products and processes. This is seen through the global uptake of NZ products in the electronics, space and healthcare industries.

Within these sectors one area that has not been so well advanced is that of componentry used within many of these products. While manufacturing has grown it is mainly focussed on the macroscale while many of the high-tech sectors use componentry with very small dimensions and even microscale features. The conventional machining processes do not capable for small scale without much expense.

This project requires the design and manufacture of a small-scale injection unit suitable for the thermal processing of thermoplastic materials in volumes less than $4cm^3$. The basic concept is that the injection unit will have a heated jacket with temperature control and will operate manually.

A series of nozzles and simple mould tools will also be needed.

The project requires;

- a literature review is to determine if there are standards in place for this type of equipment
- full design schedule including, costings, computer models and validation
- a complete set of mechanical drawings to enable fabrication of the unit
- fabrication and testing of the unit

Industry supervisor: Nil. This project supports future research at Wintec.

Research supervisor: Dr. Paul Ewart

2. **An investigation and detailed design of manufacturing equipment suitable for anodising titanium metals.**

Over the last 20 years there has been a push from the government to create and support a titanium (Ti) metals industry here in New Zealand (NZ). As NZ has a huge resource of Ti rich minerals this direction should enable the value addition to the otherwise low value product.

One issues currently being faced by those in the manufacturing sector who are developing Ti technologies is how to best treat the surface of components with complex geometries. Methods such as electro-chemical polishing, media blasting and spray coating used for stainless and carbon steels do not transfer so readily to Ti.

Aluminium (Al), like Ti has an extremely high passive oxygen layer and has good corrosion resistance in many environments. One of the most often used surface treatments for Al is anodising. Anodising not only improves surface properties and mechanical properties but also allows a range of colours to be given in support of customer requirements. Anodising has been identified as a process suitable for Ti metals but there are no known suppliers in NZ of the such a service.

This project requires the investigation of anodising techniques, followed by detailed design and manufacture of the equipment required to experiment with the process.

The project requires;

- a literature review to determine how the process works and how it might be applied to Ti metals
- a study of the equipment used for the process
- a full design schedule including, costings, computer models and validation
- a complete set of mechanical drawings to enable fabrication of the unit
- fabrication and testing of the unit

Industry supervisor: Nil. This project supports future research at Wintec.

Research supervisor: Dr. Paul Ewart

3. **An in-depth study of the electro-polishing process and how it may be applied to titanium metals.**

Over the last 20 years there has been a push from the government to create and support a titanium (Ti) metals industry here in New Zealand (NZ). As NZ has a huge resource of Ti rich minerals this direction should enable the value addition to the otherwise low value product.

One issues currently being faced by those in the manufacturing sector who are developing Ti technologies is how to best treat the surface of components with complex geometries. Methods such as electro-chemical polishing, media blasting and spray coating used for stainless and carbon steels do not transfer so readily to Ti.

This project requires the investigation of the electro-polishing process, followed by detailed design and manufacture of the equipment required to experiment with the process.

The project requires;

- a literature review to determine how the process works and how it might be applied to Ti metals
- a study of the equipment used for the process
- a full design schedule including, costings, computer models and validation
- a complete set of mechanical drawings to enable fabrication of the unit
- fabrication and testing of the unit

Industry supervisor: Nil. This project supports future research at Wintec.

Research supervisor: Dr. Paul Ewart

4. **Decreasing the rolling resistance of a single seat electric vehicle by redesigning the componentry and body shell*.**

***Still to be finalised and could split in two projects (Components and body shell)**

The global issue of air pollution began with the rise of industry and has been the bane of the manufacturers charged with creating better standards of living for the countries they support. In many developed countries, this has now been addressed to the extent that it is no longer the dominant cause of air pollution. This has now become the burden of the transport sector and as such the need for alternative forms of powering vehicles is the forefront of vehicle development.

With all major automobile manufacturers producing electric vehicles the way forward is looking promising. However, it can be seen on any day that most vehicles on New Zealand roads have a single occupant and this aspect is not being addressed.

One answer to this vehicle use inefficiency was the University of Waikato BEV project that created a single seat electric vehicle. One of the biggest issues however has been the high rolling resistance that is a by-product of using parts designed for conventional vehicles.

This project has two parts.

A. A design proposal and modification plan for componentry

B. Design and production of an aerodynamic body system

Each project part requires;

- a literature review to determine status
- a full design schedule including, costings, computer models and validation
- a complete set of mechanical drawings to enable fabrication of the unit
- fabrication and testing of the new designs

Research supervisor: Dr. Paul Ewart

Co-supervisor (Academic): Professor Mike Duke

Co-supervisor (Industry): Alain Brideson

This project supports Wintec/University/Industry collaboration.

5. **Investigating the use of FDM printed mould inserts for the metal injection moulding process.**

The manufacturing sector in NZ has for many years been a leader in the processing of plastic products. The electronics, space and healthcare industries in NZ utilise plastics processing for many components. As leading technology sectors they understand the need to continually seek new processes to enable their next generation of products. One of the main barriers to this for many other NZ based businesses is cost of R&D.

This project will investigate the use of FDM printing to produce mould inserts suitable for injection moulding low volumes of parts. The parts are targeted for use in marine applications.

The project requires;

- a background search to gather information on mould insert technology
- design, costings and computer models of an insert test system
- production and testing a range of 3D printed samples
- application and testing on mould inserts

Industry supervisor: **TBC**

Research supervisor: Dr. Paul Ewart