Materials, Design & Manufacturing Facility (CWB)

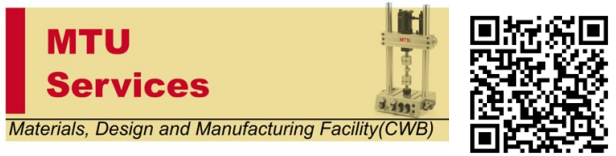
材料、設計和製造中心 (清水灣)

MDMF (CWB)

Introduction

3 Servicing Scopes

Design & Fabrication (DFU)
- End-to-End Support
- Effective Fabrication Capability
- Collaborative Engagement



Material Testing (MTU)
- Mechanical
- Material Processing
- Inspection & Analysis

MATERIALS, DESIGN AND MANUFACTURING FACILITY (CWB)

Maintenance & Repair (MRU)
- Comprehensive & Emergency Repairs
- Calibration Services
- Training & Support

Servicing Scope – Design & Fabrication

- Mechanical, electronic and controller design and fabrication supporting needs.

- End-to-End Support
  - From concept ideation to prototype development, ensuring designs meet functional, safety, performance, and manufacturing requirements.
- Effective Fabrication Capability
  - Utilizing both the fabrication suppliers at mainland China and in-house state-of-the-art equipment and processes to produce high-quality, precision-engineered components and system.
- Collaborative Engagement
  - Partnering with students, researchers, industry and outsourcing vendors to co-create solutions that are innovative, technically sound, and economically viable.

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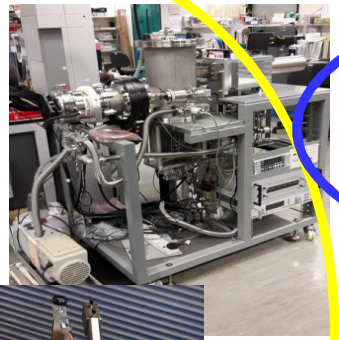
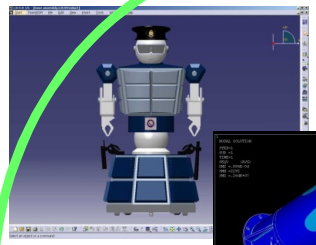
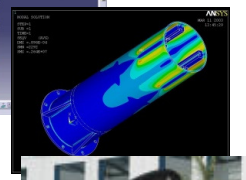
Job Request

Servicing Scope – Design & Fabrication

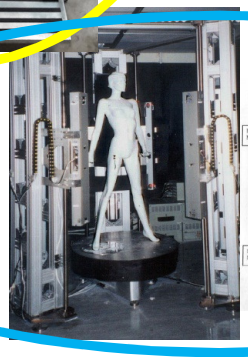


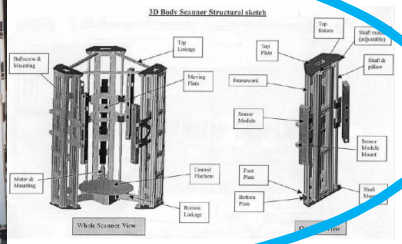


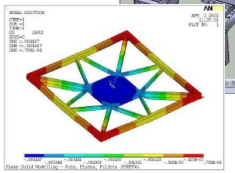


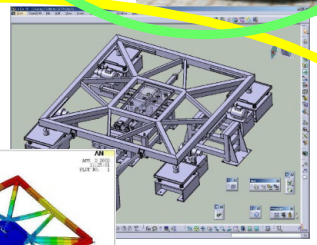
DFU Services

Materials, Design and Manufacturing Facility(CWB)





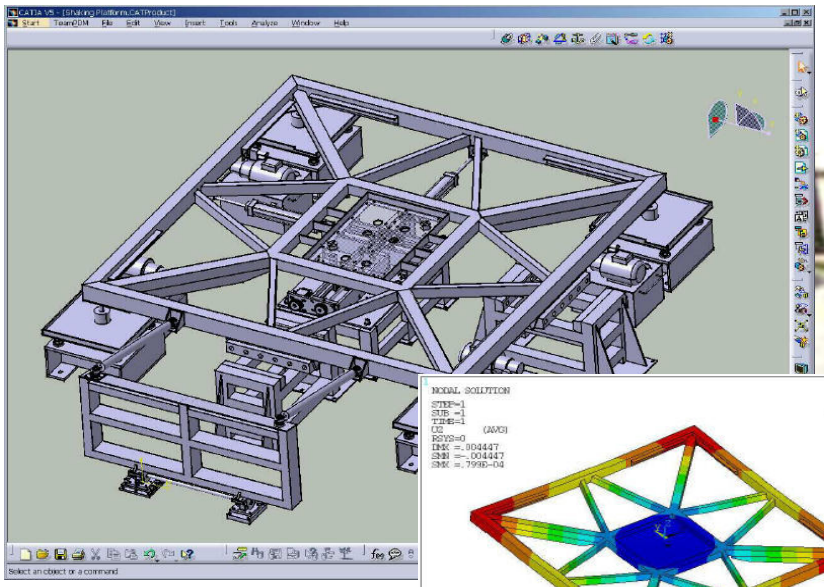




Servicing Scope – Design & Fabrication
Example Project: Shaking Platform

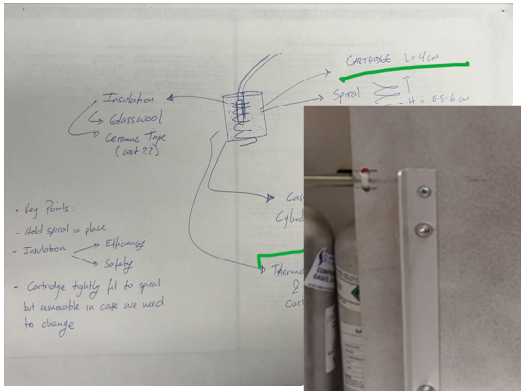
MATERIALS, DESIGN AND MANUFACTURING FACILITY(CWB)

- Design and build for engineering research purpose
  - Active vibration control of earthquake/wind excited structures.
  - Assessment of motion acceptance criteria for human occupancy in the design of flexible structures.
  - 3m x 3m which can be controlled to vibrate in a x-y horizontal direction.

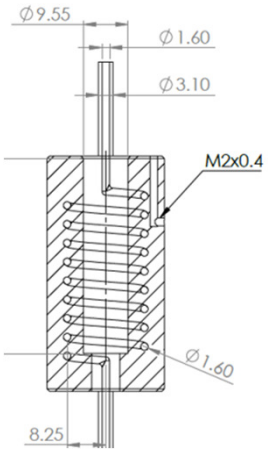


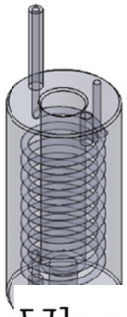
Servicing Scope – Design & Fabrication
Example Project: Spiral Cartridge Heater

- Design and build a heater and its setup for heating the gases, from 20 °C to 360°C, inside a fume cupboard.



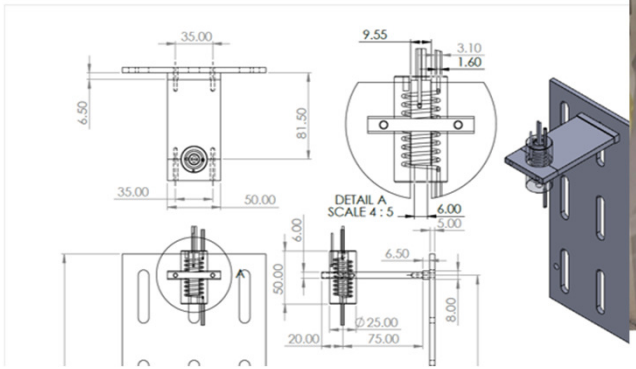

The lab. setting

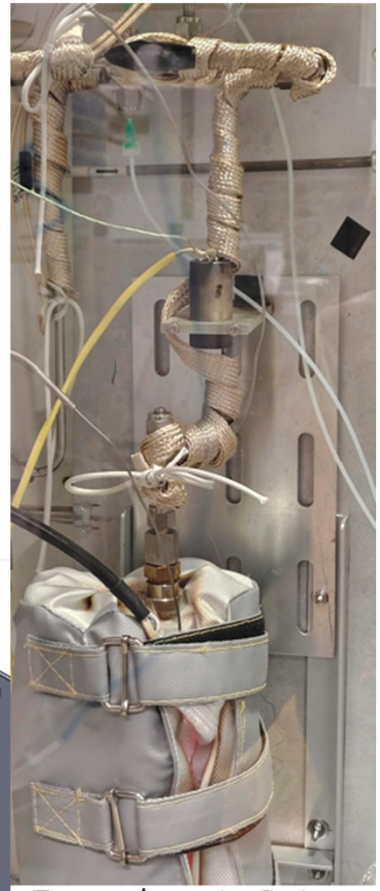





Whole setup

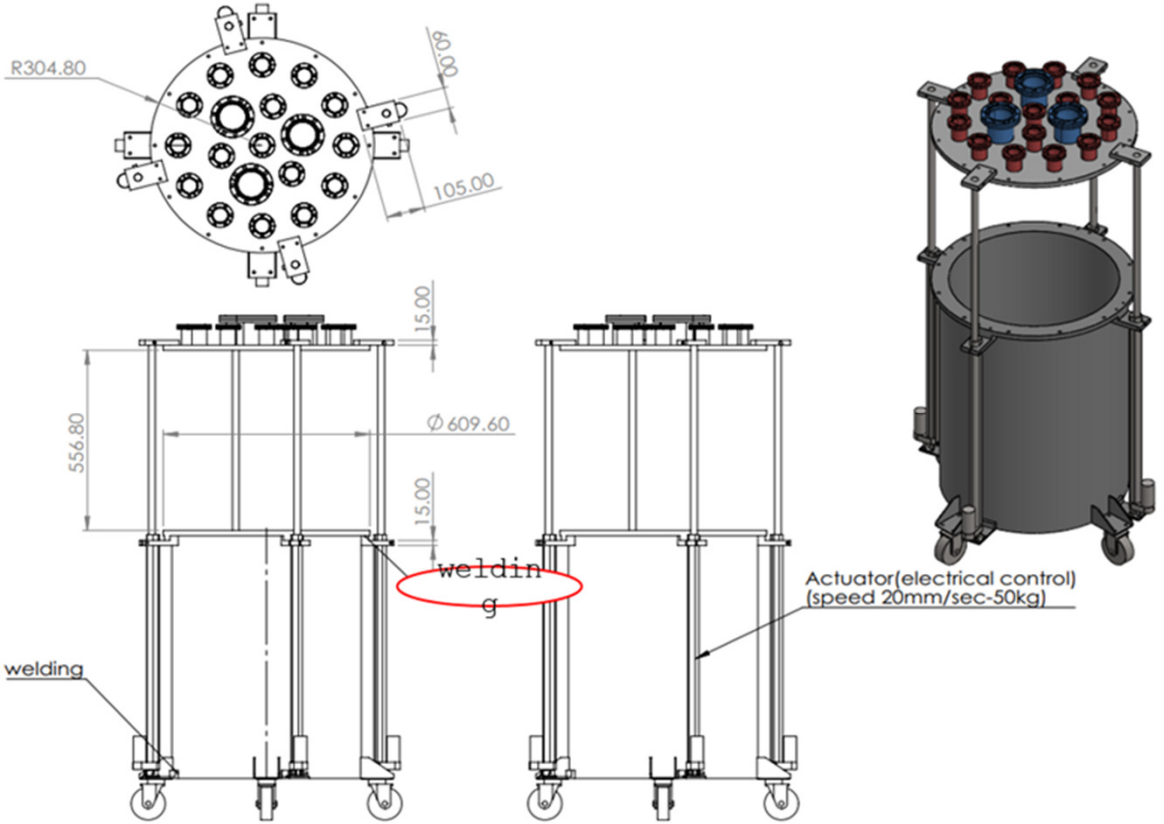
Meta
prin




Experiment Setup

Servicing Scope – Design & Fabrication
Example Project: LAr Dewar Top - Lid and Actuator

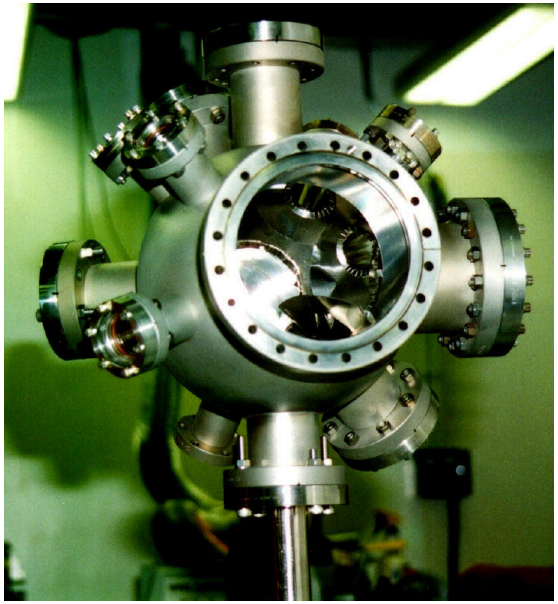
- Design and build the flanged top lid and actuator for a Lar Dewar.

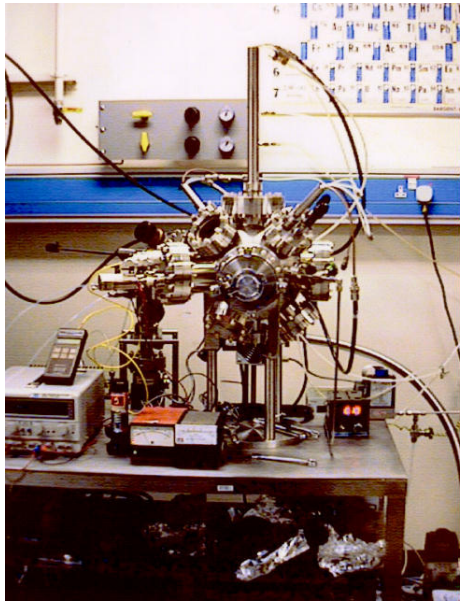


Servicing Scope – Design & Fabrication
Example Project: High Vacuum Chamber

MATERIALS, DESIGN AND MANUFACTURING FACILITY(CWB)

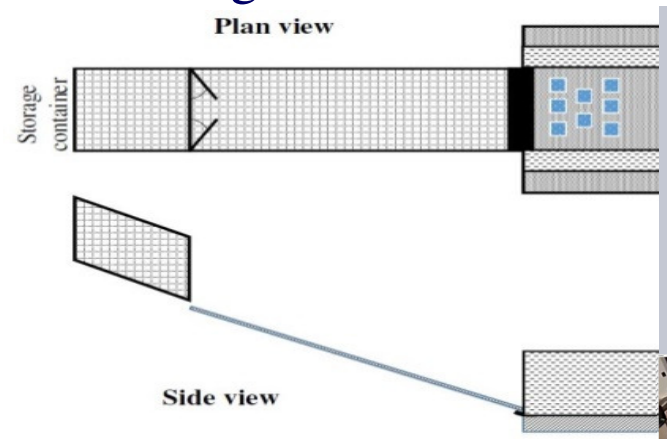
- High vacuum stainless steel chamber
  - Design and build an enhanced HVC with tailor made functionalities
  - Vacuum level less than 10^{-8} torr

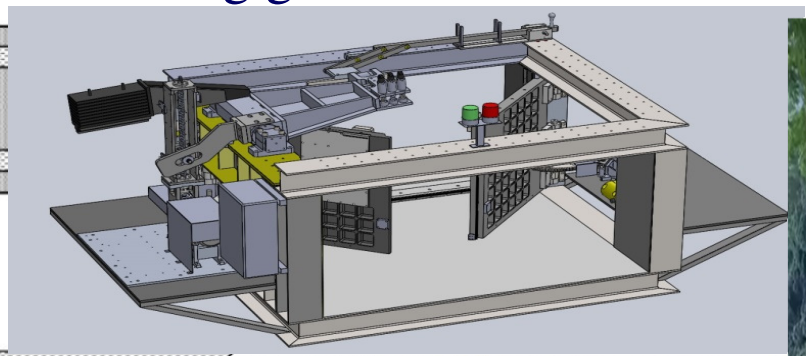


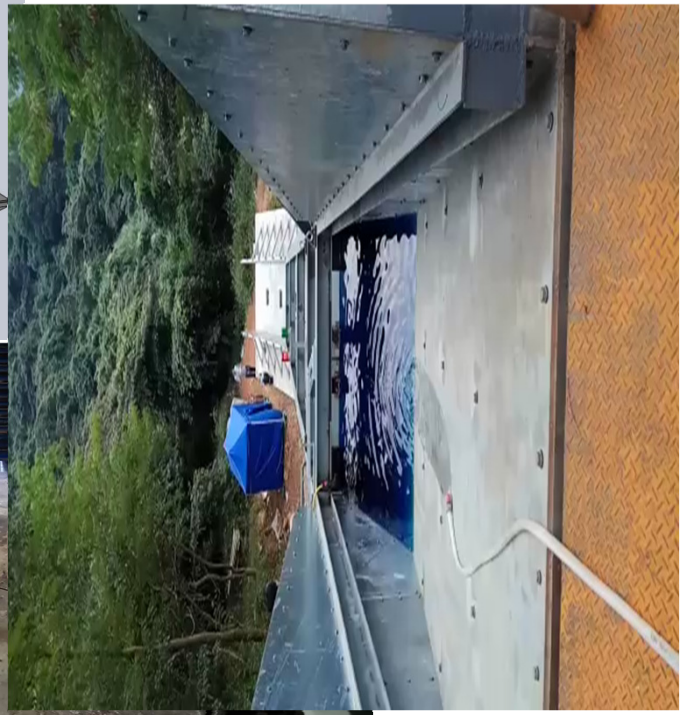


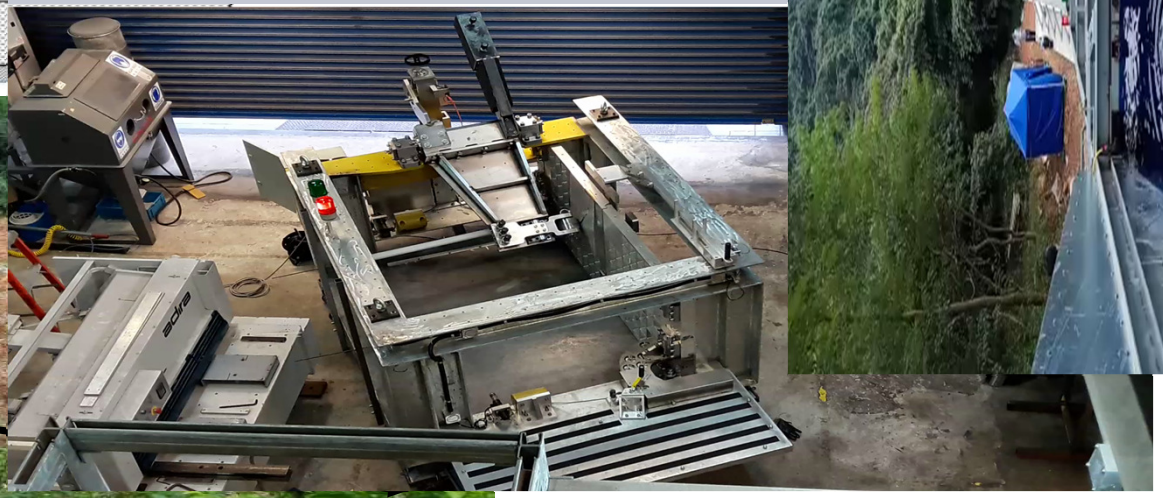
Servicing Scope – Design & Fabrication
Example Project: Soil Retention Gate

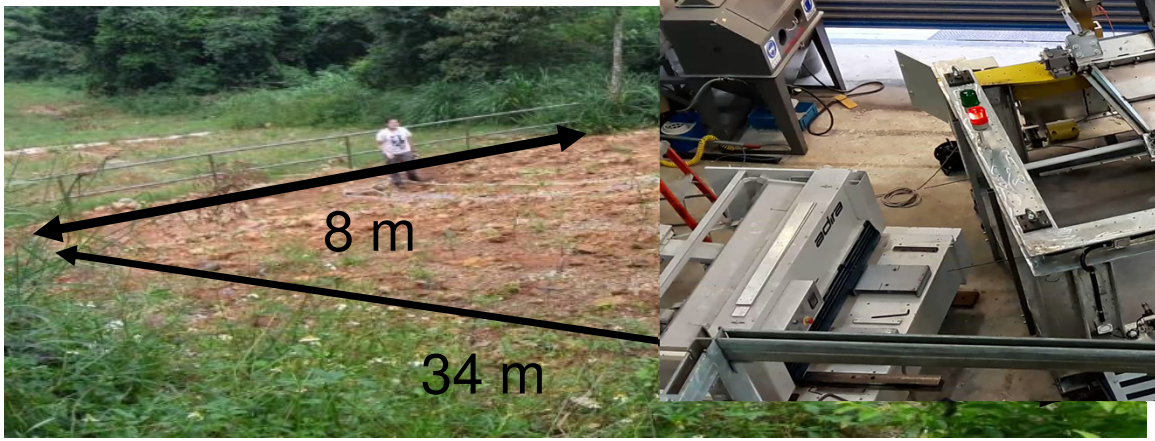
- Design and build the soil retaining gate of a flume model





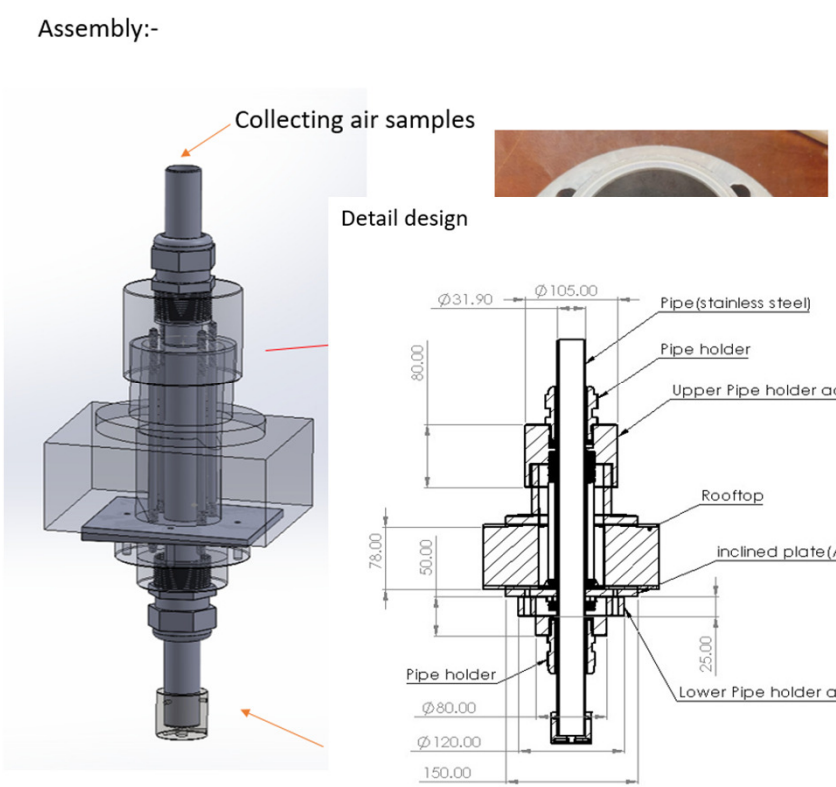






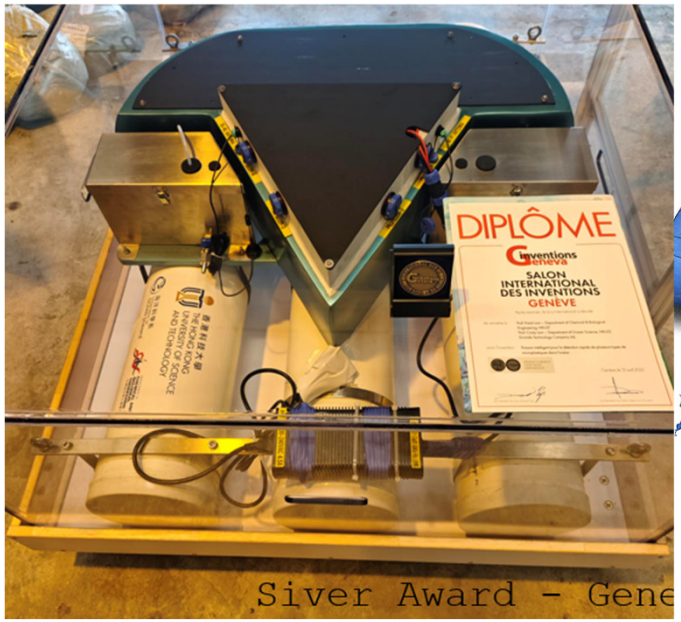
Servicing Scope – Design & Fabrication
Example Project: Real-time OCEC Inlet Adaptor

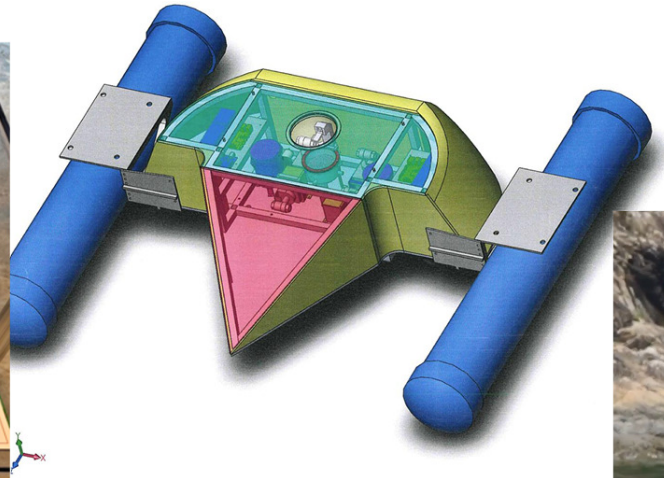
- Design and build a setup (waterproof, anti-corrosion, durable) to facilitate the collection of air sample with the online OCEC

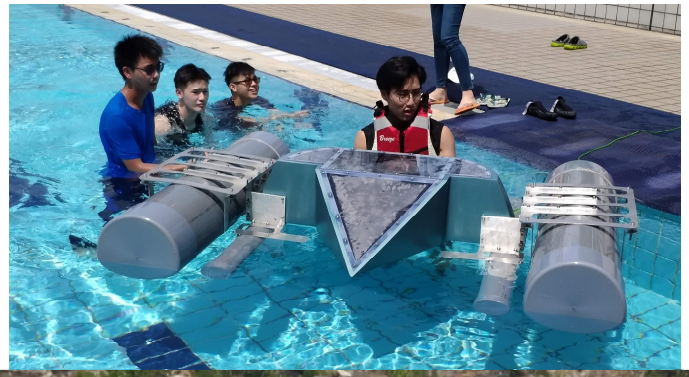


Servicing Scope – Design & Fabrication
Example Project: Smart Fish

- Electro-mechanical design, image processing, real-time data acquisition and streaming.
- Fabrication and reliability testing.

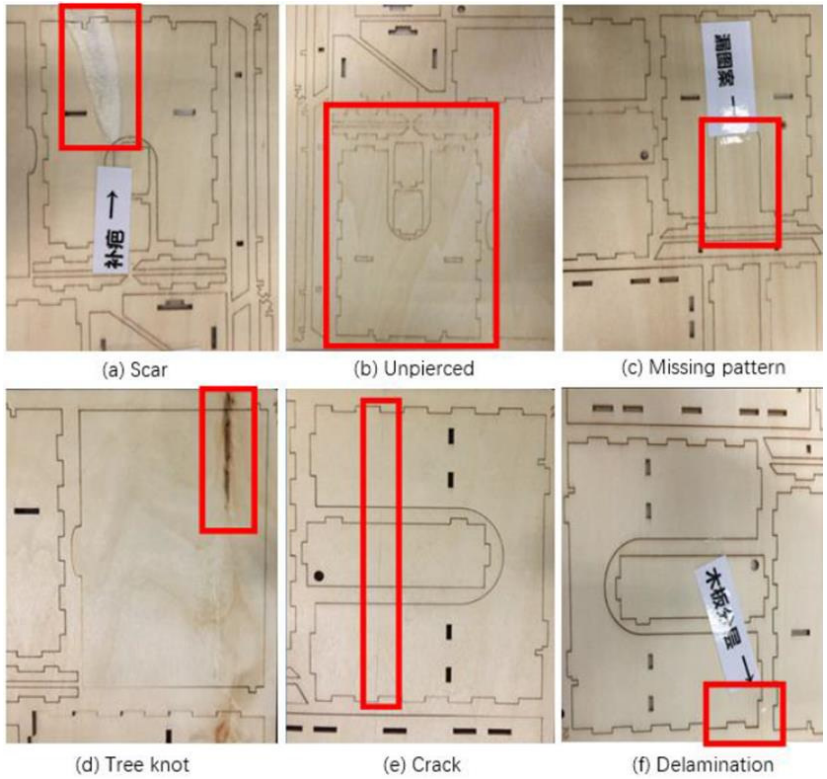


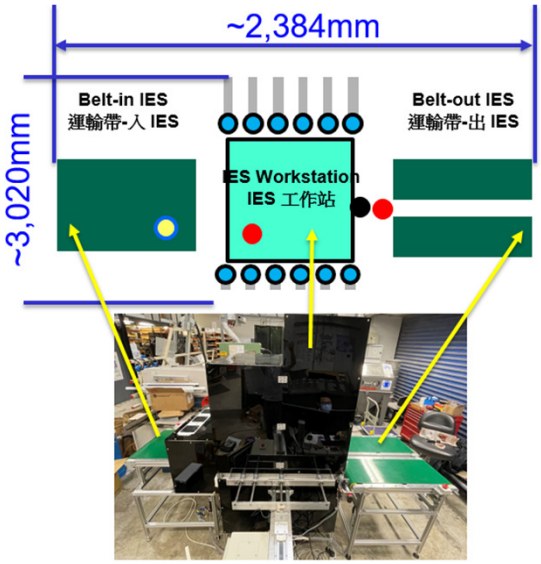


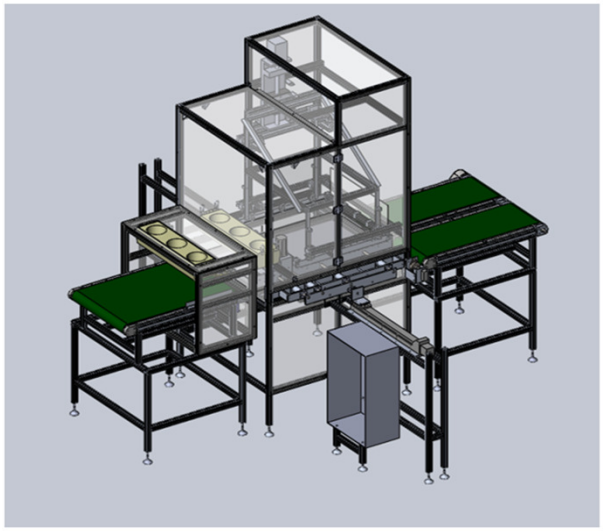


Servicing Scope – Design & Fabrication
Example Project: Automatic Flaws Inspection System

- To automate the detection process of natural and manufacturing flaws before/after laser cutting a plywood board.

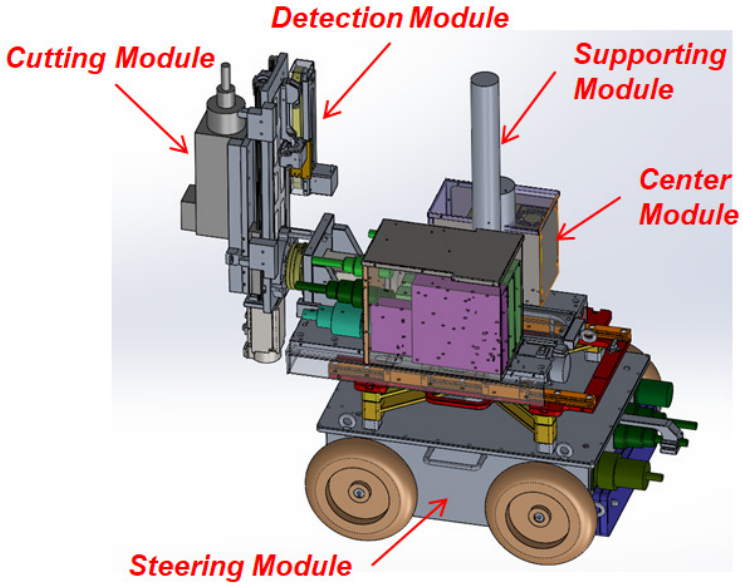


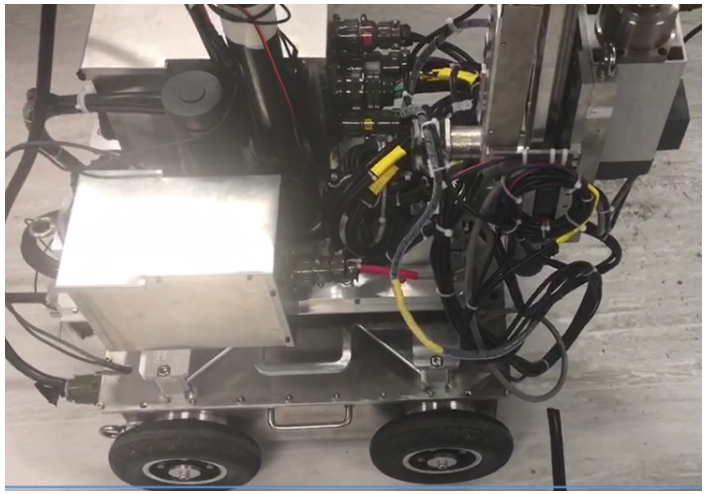


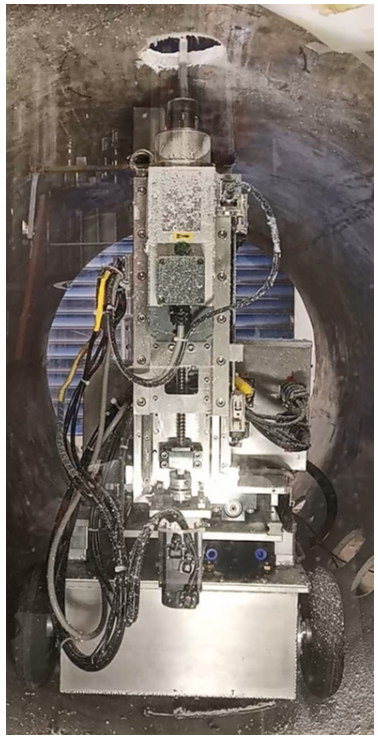


Servicing Scope – Design & Fabrication
Example Project: CIPP Repair Robot Cutter

- To develop an automatic robot cutter that can cut the lateral connection branch opening during underground drainage pipe repairing in Hong Kong.



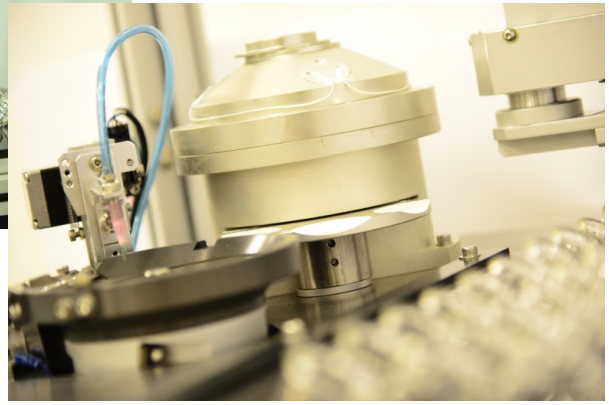


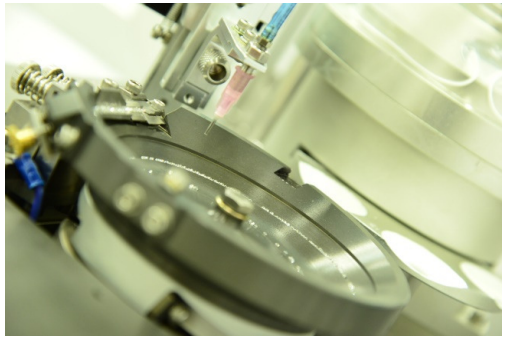


Servicing Scope – Design & Fabrication
Example Project: Diamond Sorter

MATERIALS, DESIGN AND MANUFACTURING FACILITY(CWB)

- An automation system to sort gems into different size / color / shape / transparency grades and to measure the cutting / cracks on diamonds
  - Involves the R&D of a vision system, image processing module and an electromechanical mechanism

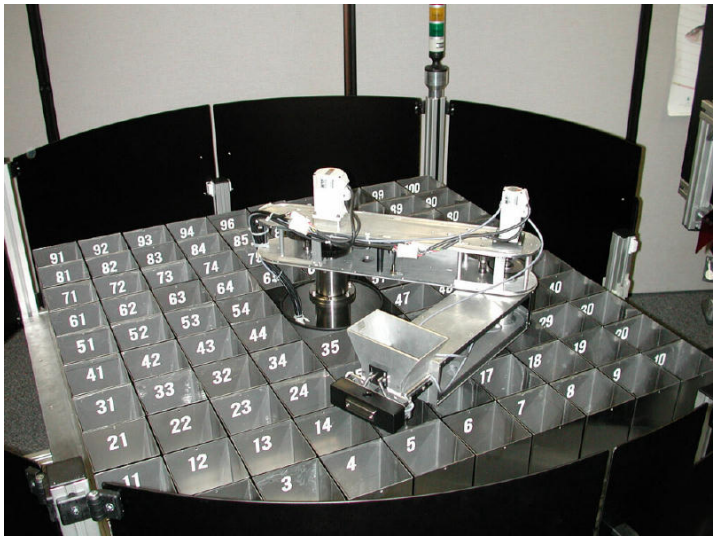


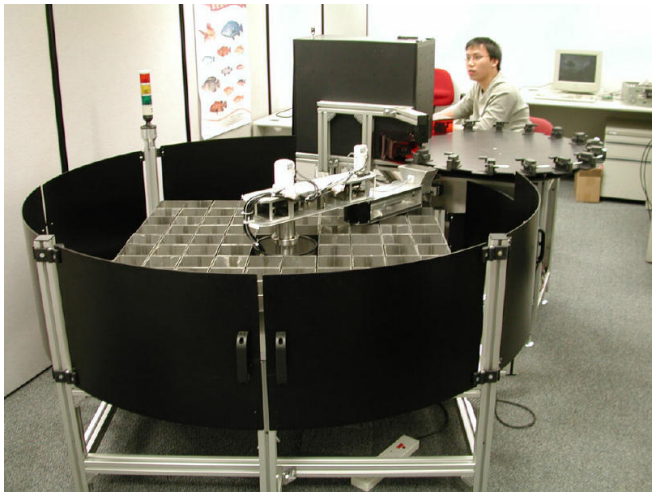


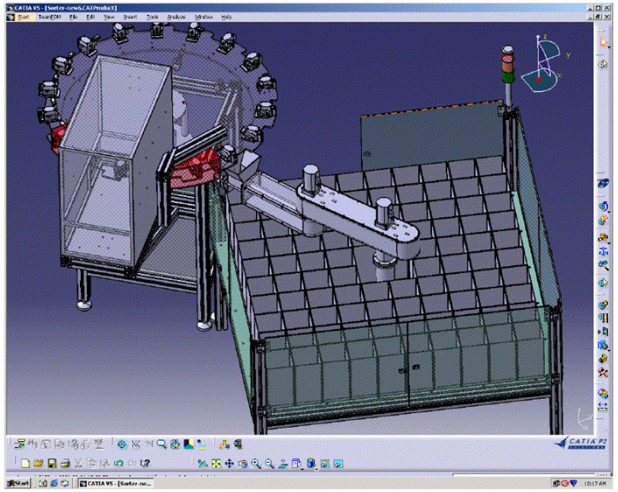
Servicing Scope – Design & Fabrication
Example Project: Feather Sorter

MATERIALS, DESIGN AND MANUFACTURING FACILITY(CWB)

- To sort feathers of different features for the shuttlecock manufacturing industry.
  - Involves the R&D of a turning table, an image processing system and a robotic arm, which selects feather into the bin matrix according to their degree of curvature



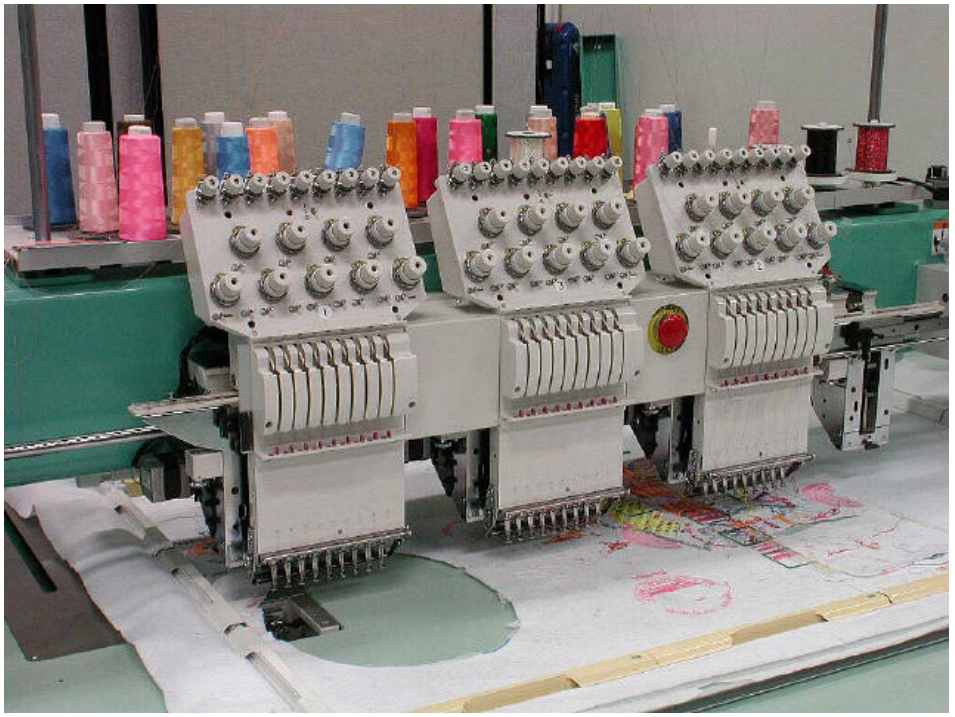




Servicing Scope – Design & Fabrication
Example Project: Controller for Embroidery Machine

MATERIALS, DESIGN AND MANUFACTURING FACILITY(CWB)

- Design and develop a controller to control the embroidery machine more precisely and at higher speed, with less vibration
  - Linux in an embedded system, with advanced control algorithms for accurate positioning, tension control, automatic compensation of vibration



Servicing Scope – Design & Fabrication Engineering / Robotic Competition Projects

MATERIALS, DESIGN AND MANUFACTURING FACILITY(CWB)

- RoboCon
- ROV
- Cybathlon
- Pedal Kart
- Power Bike
- …

Servicing Scope – Design & Fabrication
Fabrication Facilities

MATERIALS, DESIGN AND MANUFACTURING FACILITY(CWB)

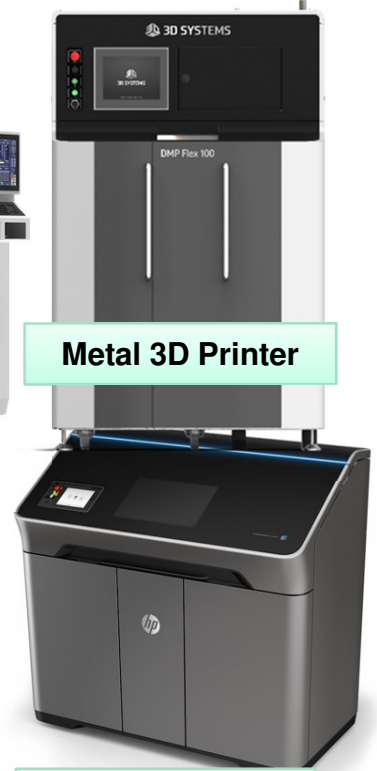
- Metal, Plastics, Composite – CNC Milling/Turning/TurnMill, EDM Die-sink/WireCut/Hole-drill, Ultrasonic machining, 3D printing, Laser cutting, Waterjet


CNC TurnMill


EDM WireCut


EDM Die-Sink


EDM Hole-drill


Metal 3D Printer

Nylon 3D Printer

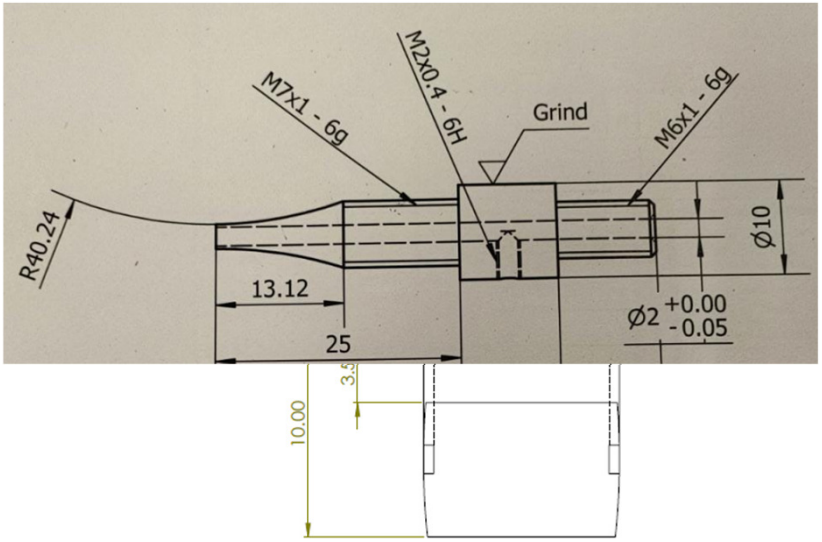


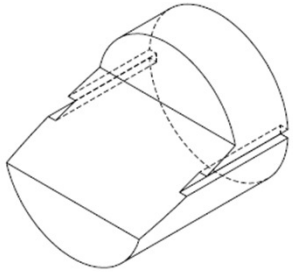
Resin 3D Printer

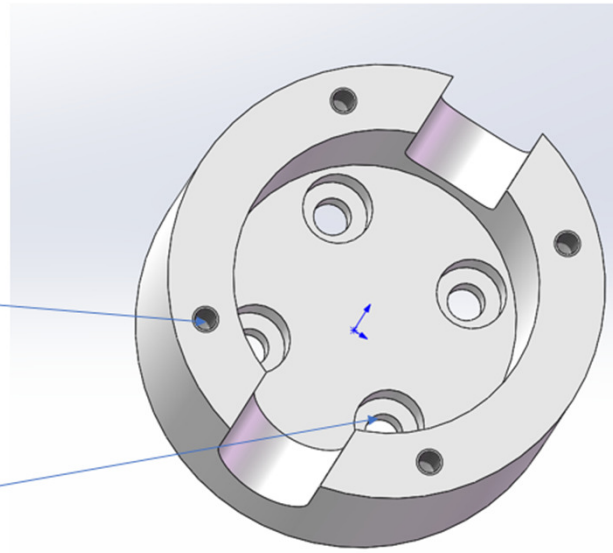

Ultrasonic Machining

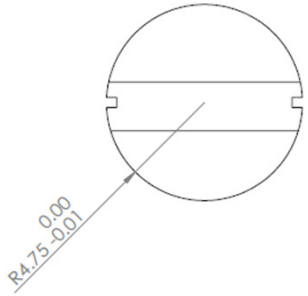

Metal Laser Cutting

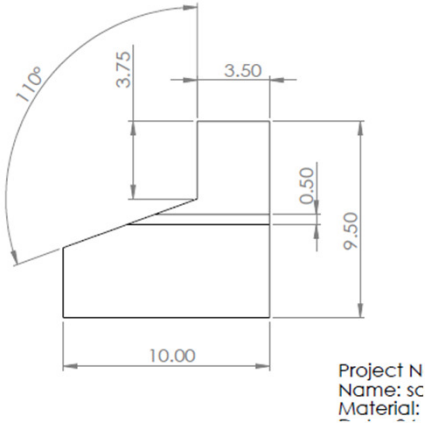
Servicing Scope – Design & Fabrication
Fabrication – CNC TurnMill

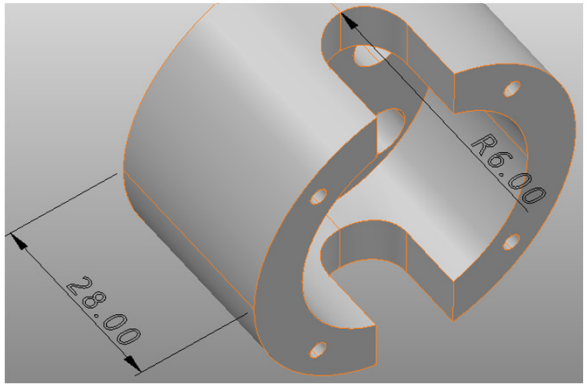






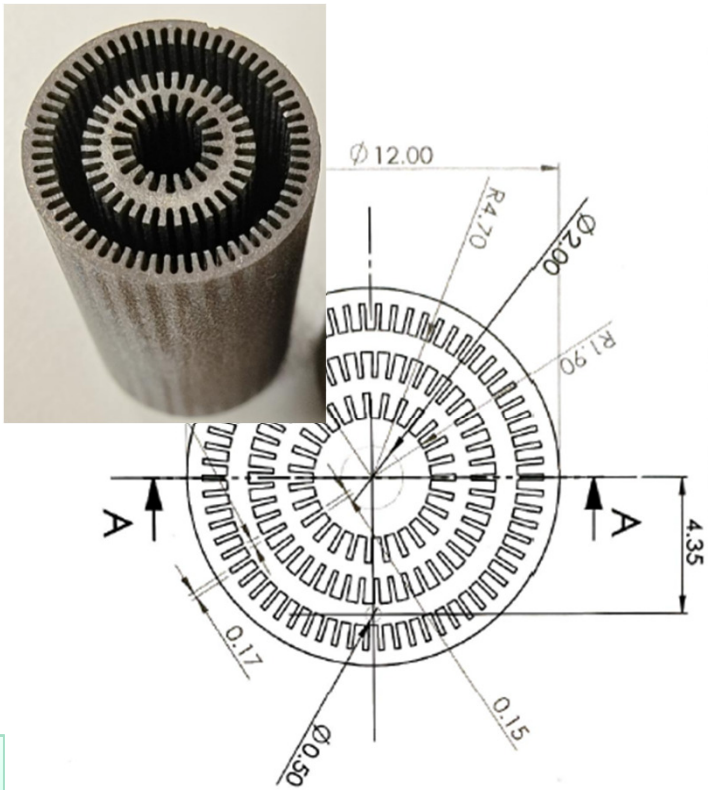




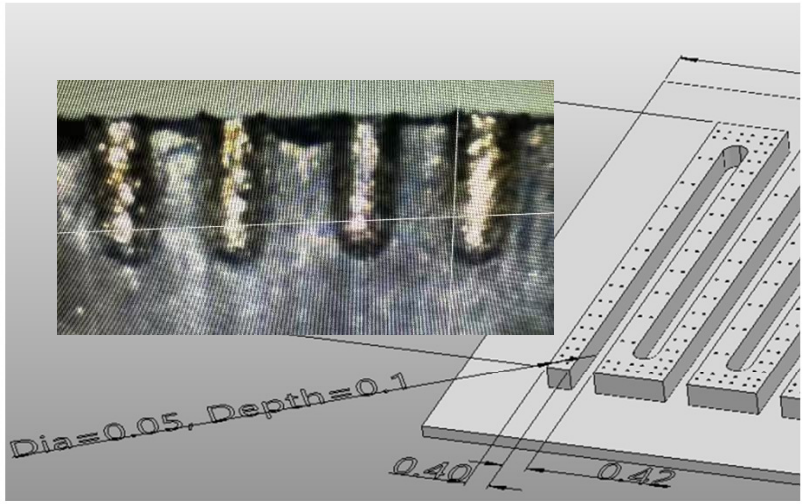


Servicing Scope – Design & Fabrication
Fabrication – EDM Die-sink/WireCut/Hole-drill

EDM Die-sink
Min. surface roughness ~ 0.05µm
Min. in-corner radius ~ 5µm

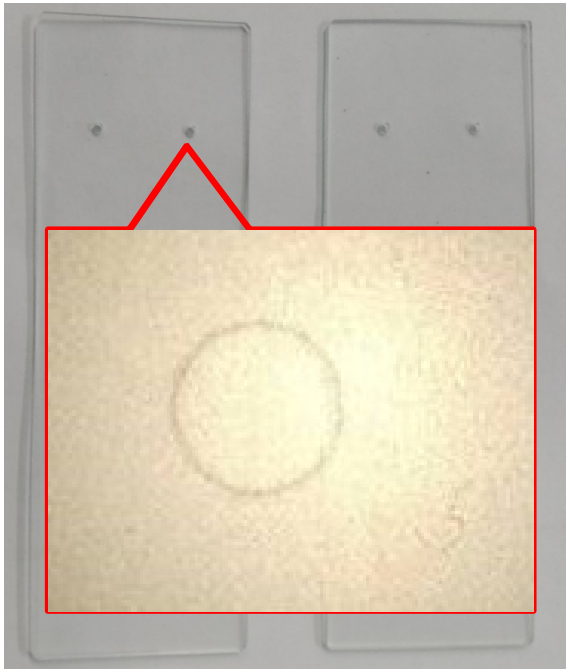


EDM WireCut
Smallest wire dia. = 0.05mm

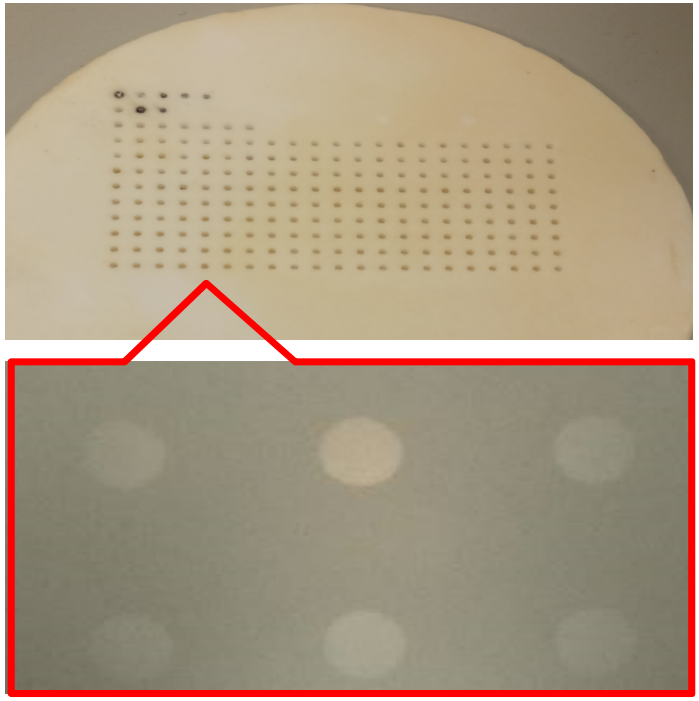


EDM Hole-drill
Smallest hole dia. = 0.05mm,
Depth = 1mm

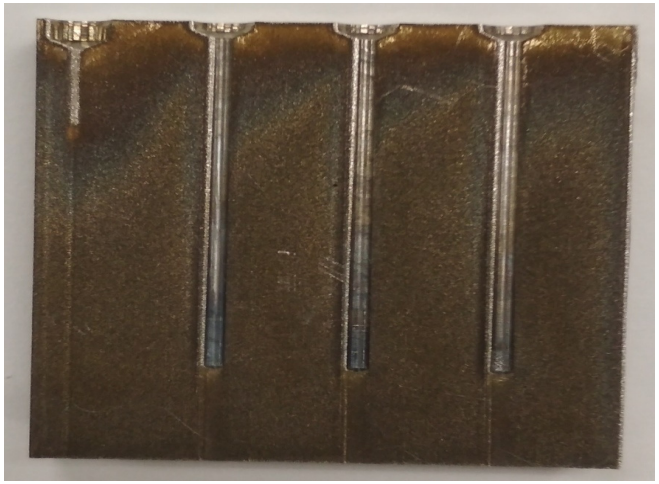
Servicing Scope – Design & Fabrication
Fabrication – Ultrasonic Machining



Glass, Small thru' hole
Dia. = 0.6mm, Thickness = 1mm



Alumina, Small blind hole
Dia. = 1.2mm, Depth = 1.4mm

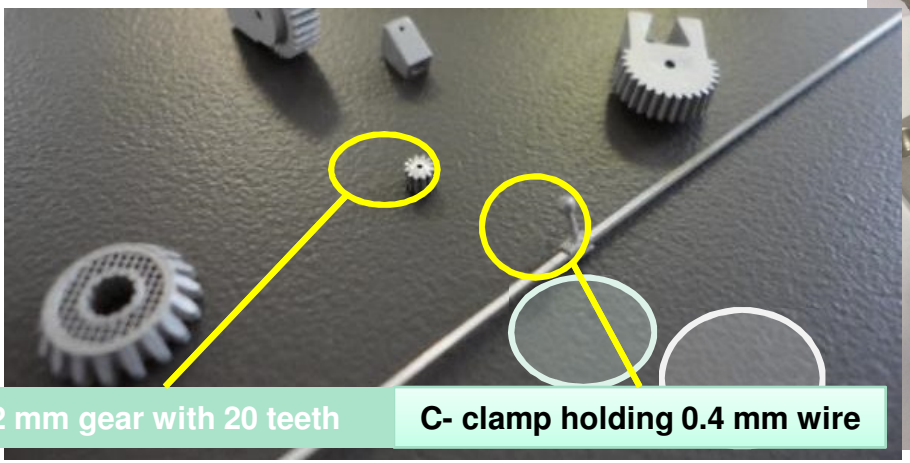


Shape memory alloy, Small thru' hole
Dia. = 0.75mm, Thickness = 2mm

Stainless steel, Small blind hole
Dia. = 0.2 & 0.9mm, Depth = 5mm & 20mm

Servicing Scope – Design & Fabrication
Fabrication – Metal 3D Printing

- Metal 3D printer – DMP Flex100
  - Build volume 100 x 100 x 80 mm
  - Layer thickness: 10 ~ 100 μm
  - Typical accuracy: ± 0.1-0.2% with ± 50 μm minimum
  - Supported materials:
    - LaserForm 316L (B)
    - LaserForm 17-4PH (B)
    - LaserForm CoCr (B)



Servicing Scope – Design & Fabrication
Fabrication – Nylon 3D Printing

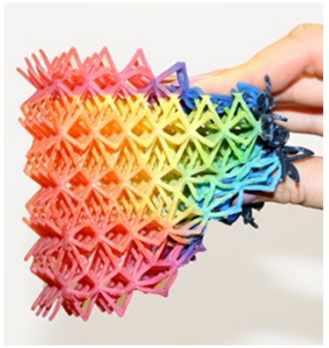
- Nylon 3D printer – HP Jet Fusion 540
  - Support less printing
  - Build volume 332 x 190 x 248 mm
  - Layer thickness: 0.08 mm
  - Typical accuracy: ± 0.3% with ± 0.2 mm minimum
  - Supported materials:
    - Nylon PA12






Servicing Scope – Design & Fabrication
Fabrication – Industrial SLA 3D Printing

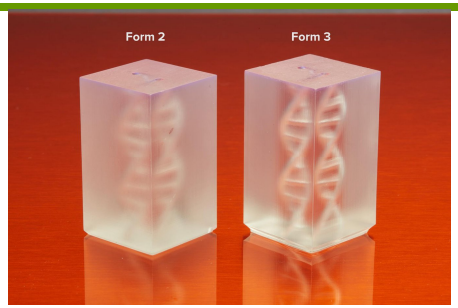
- Industrial SLA 3D printer – J850 PRIME
  - Build volume 490 x 390 x 200 mm
  - Layer Thickness : down to 14 μm
  - File Formats for Printing :
    - Color and Texture: 3MF / OBJ / SolidWorks / VRML
    - Color: CATIA / Creo / Inventor / IGES / JT / Parasolid / NX / SolidEdge / STEP
    - None: STL
  - Accuracy :
    - Under 100 mm – ±100μ
    - Above 100 mm – ±200μ or ± 0.06% of part length, whichever is greater
  - Digital model materials: Unlimited number of composite materials including:
    - Over 600,000 colors with VeroUltra
    - Rubber-like materials in a variety of Shore A values
    - Translucent color tints

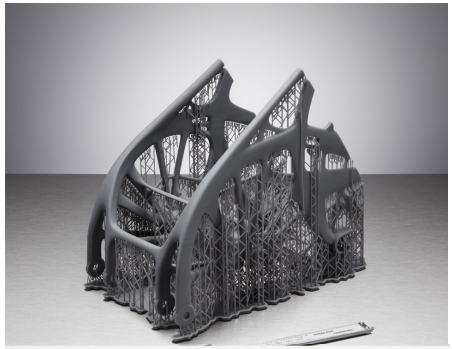


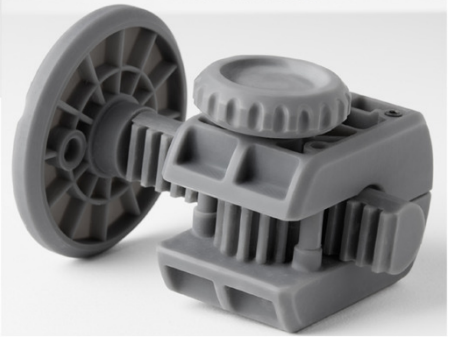
Servicing Scope – Design & Fabrication
Fabrication – Desktop SLA 3D Printing

MATERIALS, DESIGN AND MANUFACTURING FACILITY(CWB)

- Desktop SLA 3D printer – Form 3L
  - Build volume 335 x 200 x 300 mm
  - Layer Thickness 0.025 - 0.3 mm
  - File Formats for Printing: STL, OBJ
  - Low Force Stereolithography (LFS)™



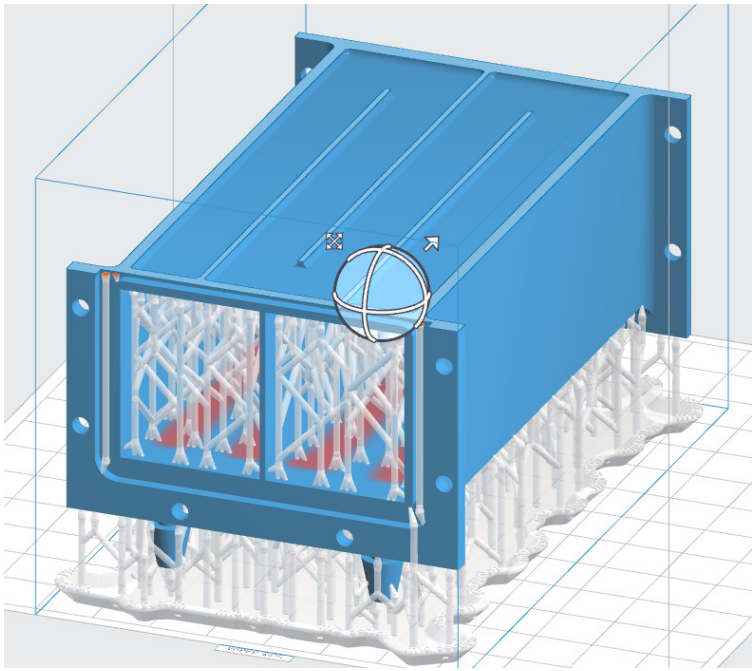


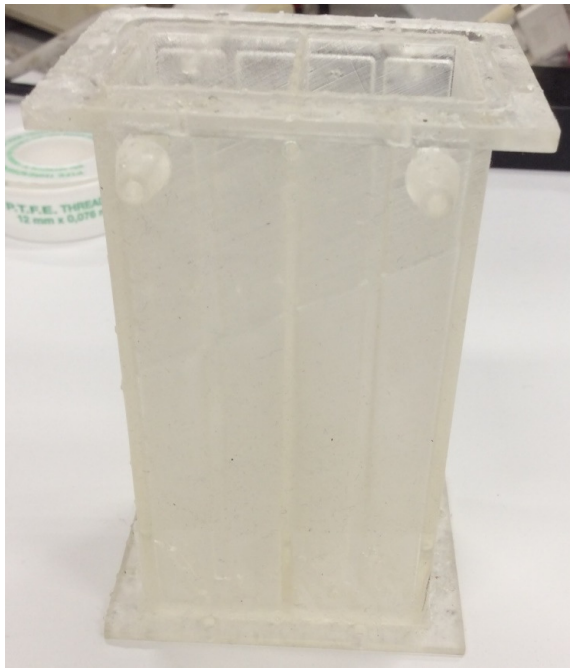


Servicing Scope – Design & Fabrication
Fabrication – Desktop SLA 3D Printing

MATERIALS, DESIGN AND MANUFACTURING FACILITY(CWB)

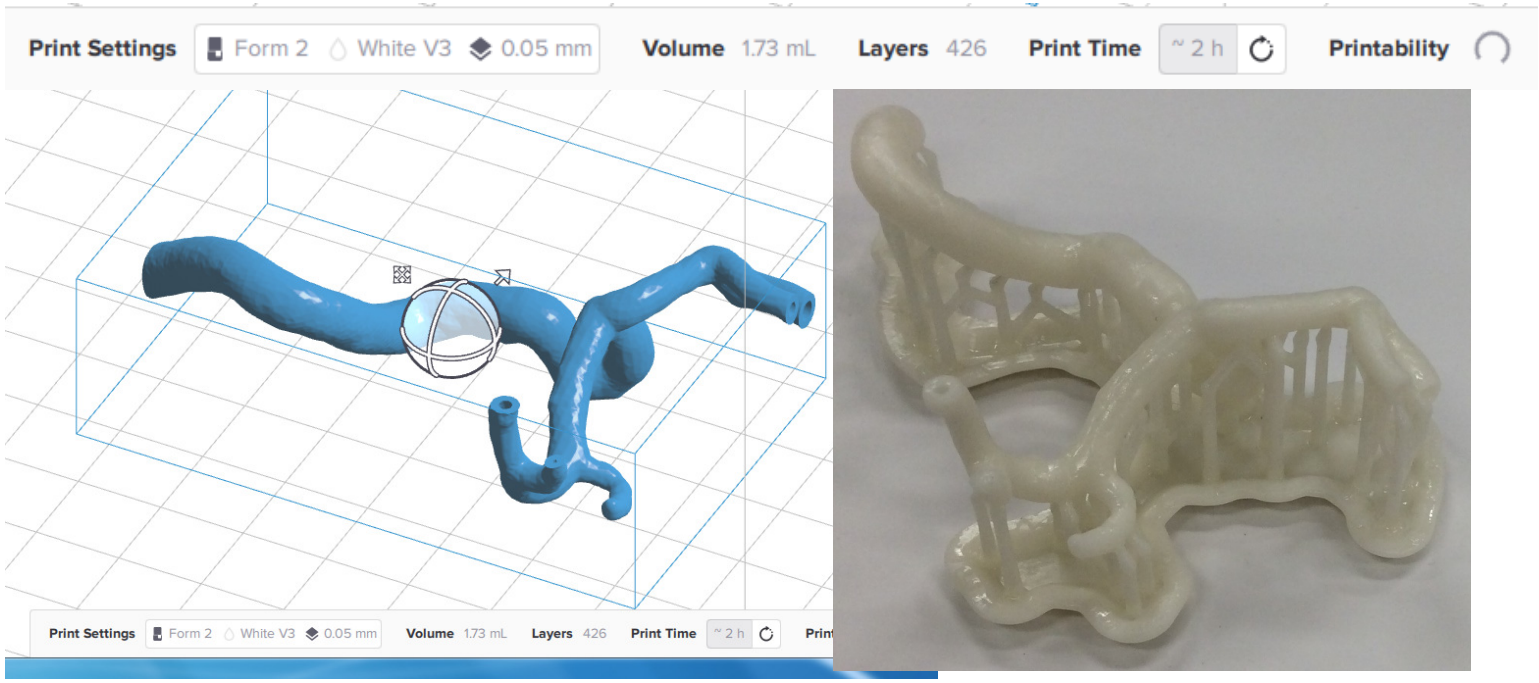
- Water channel model
  - Materials – Standard Clear
  - Channel size = 2.5mm
  - Internal water circulation





Servicing Scope – Design & Fabrication
Fabrication – Desktop SLA 3D Printing

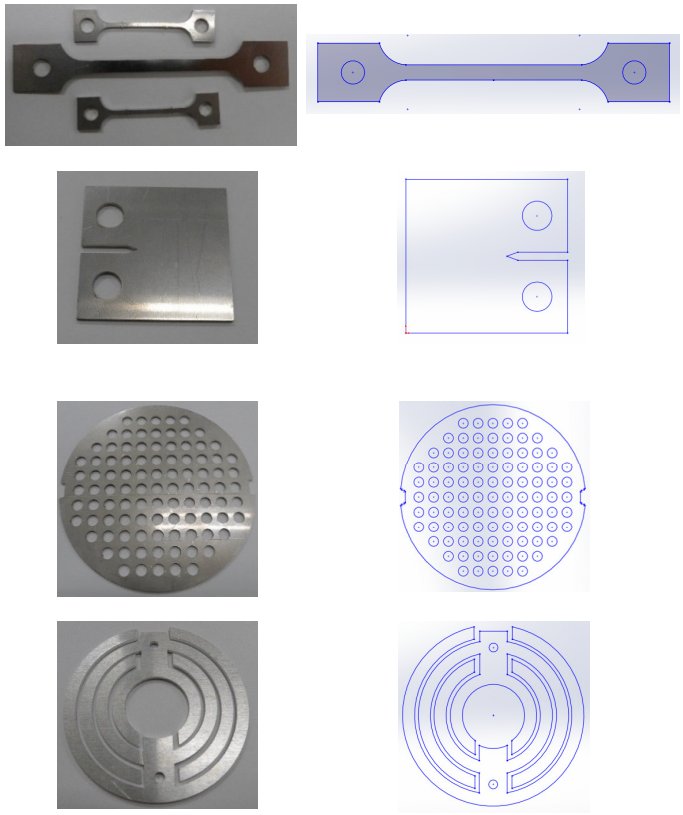
- Blood vessel
  - Materials – Standard White
  - Minimum feature size = 0.5mm



Servicing Scope – Design & Fabrication
Fabrication – Metal Laser Cutting

MATERIALS, DESIGN AND MANUFACTURING FACILITY(CWB)

- Examples
  - Shape Memory Alloy specimens
    - Tensile specimen:
      - Materials / Thickness: 1mm
      - Production time: 45 second
    - Crack specimen:
      - Materials / Thickness: 1.5mm
      - Production time:1 min.
  - Stainless Steel Filter specimen
    - Materials / Thickness: 1.2mm
    - Production time:8min. 30 second
  - Titanium Electrode specimen
    - Materials / Thickness: 1mm
    - Production time: 2min.



Servicing Scope – Maintenance & Repair

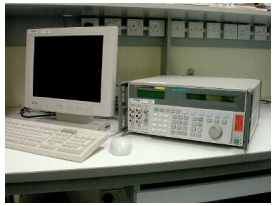
- Maintain the integrity and functionality of university equipment and support research and teaching activities.

- Repair and Maintenance
  - Comprehensive repair and maintenance of research equipment and general equipment.
- Emergency Repairs
  - Urgent repairs to ensure safety and functionality of equipment.
- Calibration Services
  - Calibration of measuring instruments and equipment to ensure accurate measurements.
- Training and Support
  - Conducting training courses on maintenance practices of university equipment for technical staff and PG students.

Home Page

Job Request

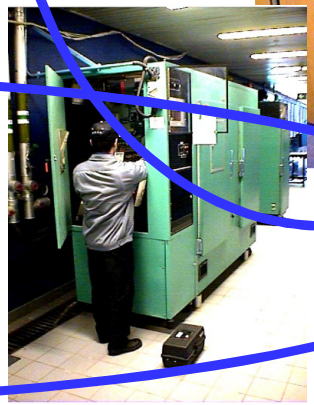
Servicing Scope – Maintenance & Repair


MRU Services

Materials, Design and Manufacturing Facility(CWB)



Servicing Scope – Material Testing

- Provides technical expertise and platform to conduct research on mechanical, material processing, inspection & analysis.

- For evaluation of static and fatigue testing of micron-Newton loads to tons load, offering the precision necessary for low-force testing 500μN to high-force testing 100kN.
- Instrumentation for surface and interfacial analysis, characterization of physical properties, and mechanical properties testing.
  - Nanoindenters, optical profiler, contact angle meter, Zeta potential/nano-particle analyzer
  - Mechanical testing machines
  - Scanning acoustic microscope, particle size analyzer, microscope, image processing system

MTU Services
Materials, Design and Manufacturing Facility(CWB)

Home Page

Machine Booking

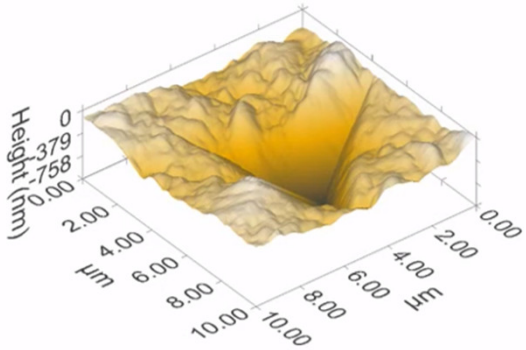
Servicing Scope – Material Testing

- Nano-measurement – Nano Indenter

Nano Indenter

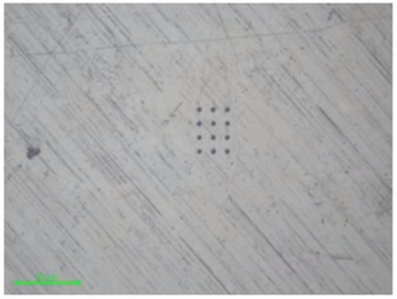
	Indentation Axis	Lateral Axis
Maximum Force	10 mN	2 mN
Maximum Indentation Displacement	5 µm	500 nm
Maximum Lateral Displacement	N/A	15 µm
Thermal Drift	<0.05 nm/sec	<0.05 nm/sec
Load Noise Floor	20 nN	3.5 µN
Load Resolution	1 nN	50 nN
Displacement Resolution	0.006 nm	0.02 nm
Displacement Noise Floor	0.1 nm	2 nm
Maximum Range of Piezoelectric Scanner	60 µm x 60 µm	60 µm x 60 µm

In situ SPM Imaging



Indented surface of bovine dentin

Optical Microscope to navigate sample


Array of indents in Polycarbonate

Servicing Scope – Material Testing

- Mechanical Testing
  - Also known as destructive testing, reveals the properties of a material under dynamic or static force

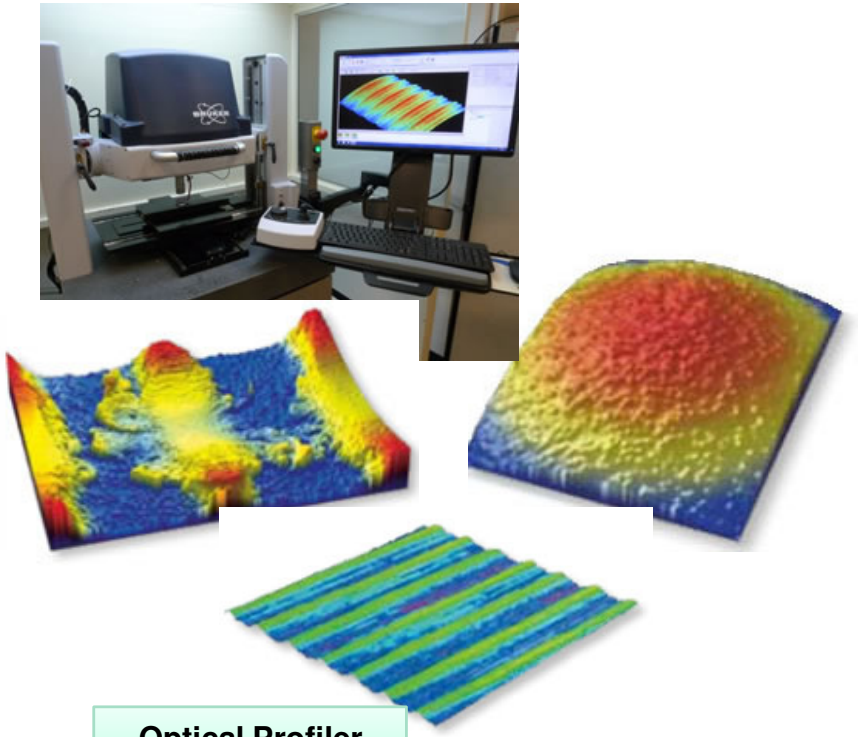
MTS 810
5KN to 100KN

MTS 858
15kN Axial and 100 Nm Torsion

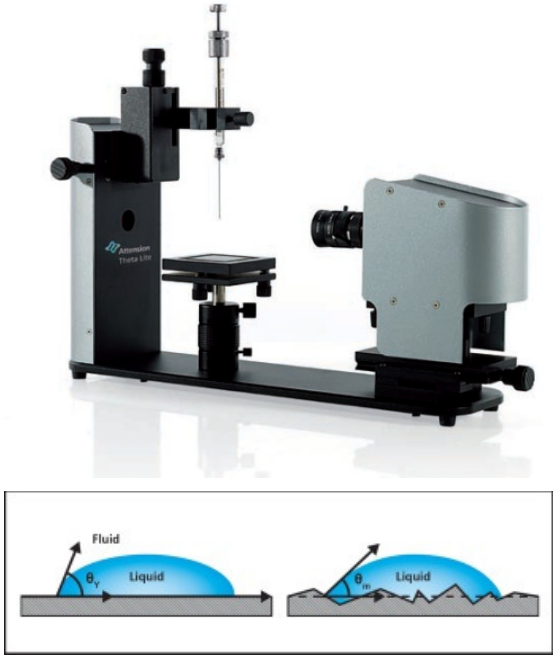
MTS 858 Mini Bionix
25KN Axial, 250 Nm Torsion

Servicing Scope – Material Testing

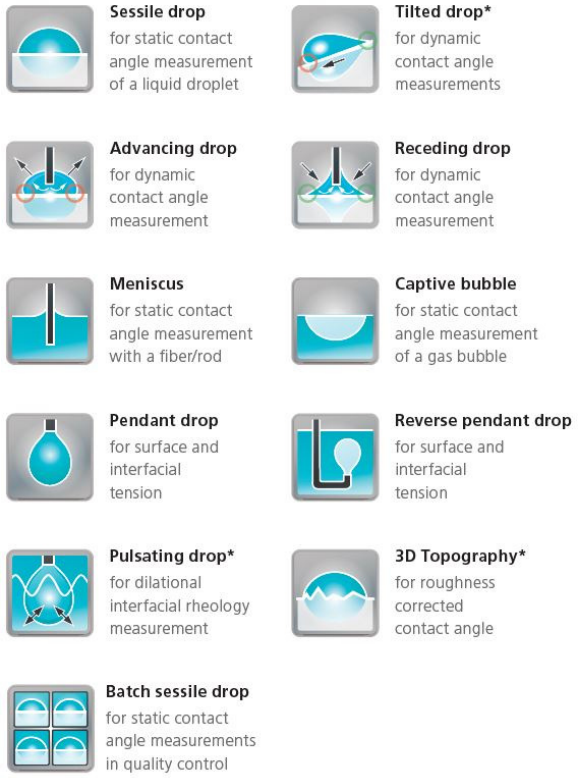
- Inspection and Failure Analysis
  - Determining the root cause of parts/assembly failure and working out the means for correcting and preventing current/future problems



Optical Profiler



Contact Angle Meter



Servicing Scope – Material Testing

- Inspection and Failure Analysis
  - Determining the root cause of parts/assembly failure and working out the means for correcting and preventing current/future problems

C-SAM: Sonix Quantum 350H
Spatial resolution:0.5 µm
Depth resolution: 8 µm

X Ray with CT imaging inspection system:
yxlon Cougar EVO
Detail Detectability : < 0.75µm
Spatial Resolution : 1.5µm
Max. Object Size : 440mm x 540mm

Servicing Scope – Material Testing

- Inspection and Failure Analysis
  - Determining the root cause of parts/assembly failure and working out the means for correcting and preventing current/future problems

Zeta Potential / Nano-particle Analyzer: ZetaPlus
Zeta Potential Range : -150 to + 150 mV
Size Range : 10nm to30μm

TecScan 7 Axis Immersion Scanner
1600mm x 800mm x 800mm sample length

Servicing Scope – Material Testing

- Inspection and Failure Analysis
  - Determining the root cause of parts/assembly failure and working out the means for correcting and preventing current/future problems

Particle Size Analyzer
Measurement capability
from 0.01 to 2800 microns

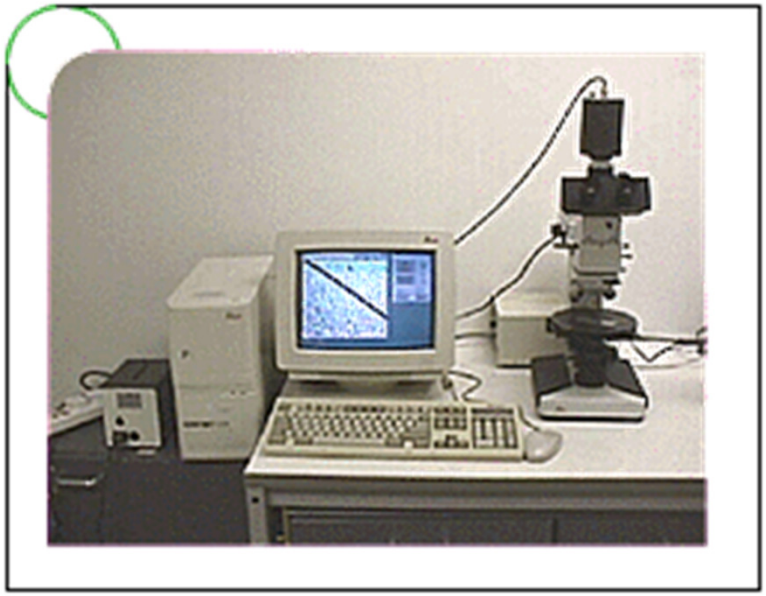


Image Processing System
Leica QUANTIMET 500+

Servicing Scope – Material Testing

- Material Processing
  - Processing of metal heat treatment, polymer and carbon composite

Centrifuge Z 326

Autoclave

Hydraulic Hot Press

Humidity Chamber

Misonix XL2020 Sonicator

Oven: Heating and Drying

Furnace