

# Welcome to the Department of Mechanical Engineering Sciences

Dr Simão Marques



# Why Engineering?

A recent report...

‘Engineers are crucial to the economy and society as a whole.

Engineers are the innovators and problem-solvers who really make a difference to people’s lives.

Engineers are the people behind innovations such as driverless cars, bionic limbs and space travel.

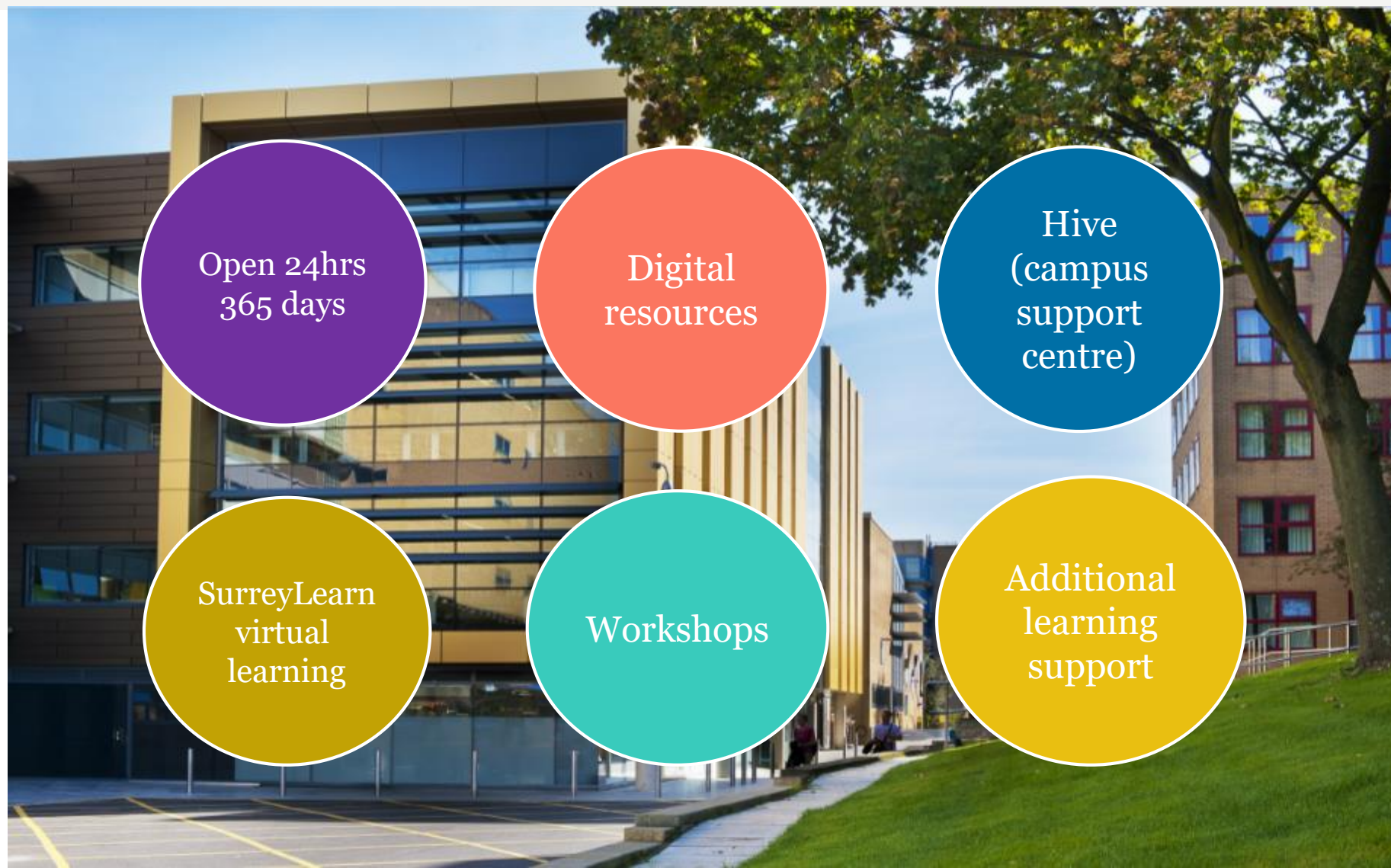
However the UK is facing an engineering skills shortage. Recent figures indicate that we need 69,000 more engineers in the UK every year just to meet industry demand.’

## Engineering UK 2016

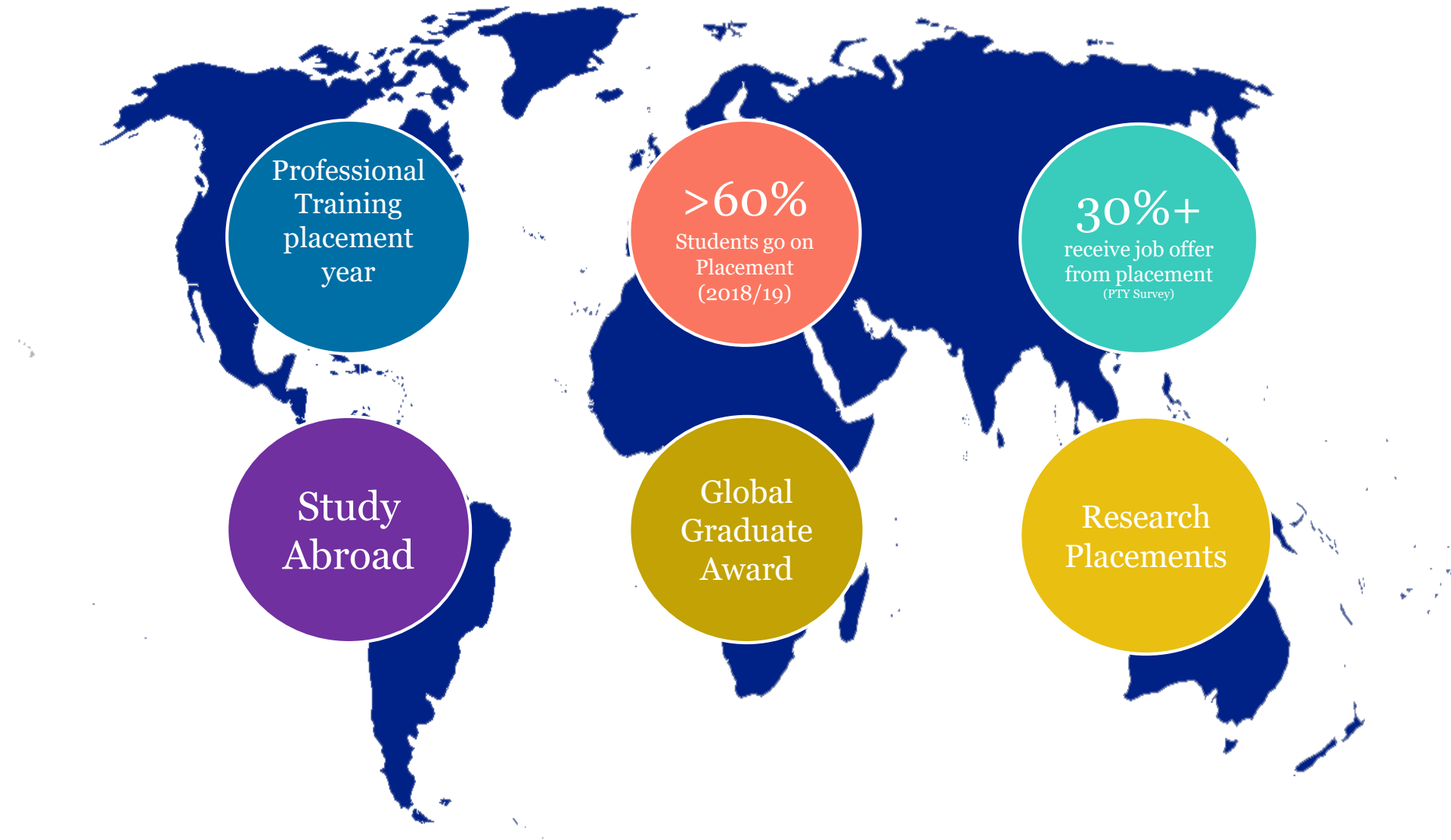
The state of engineering



# Award winning facilities



# Opportunities at Surrey





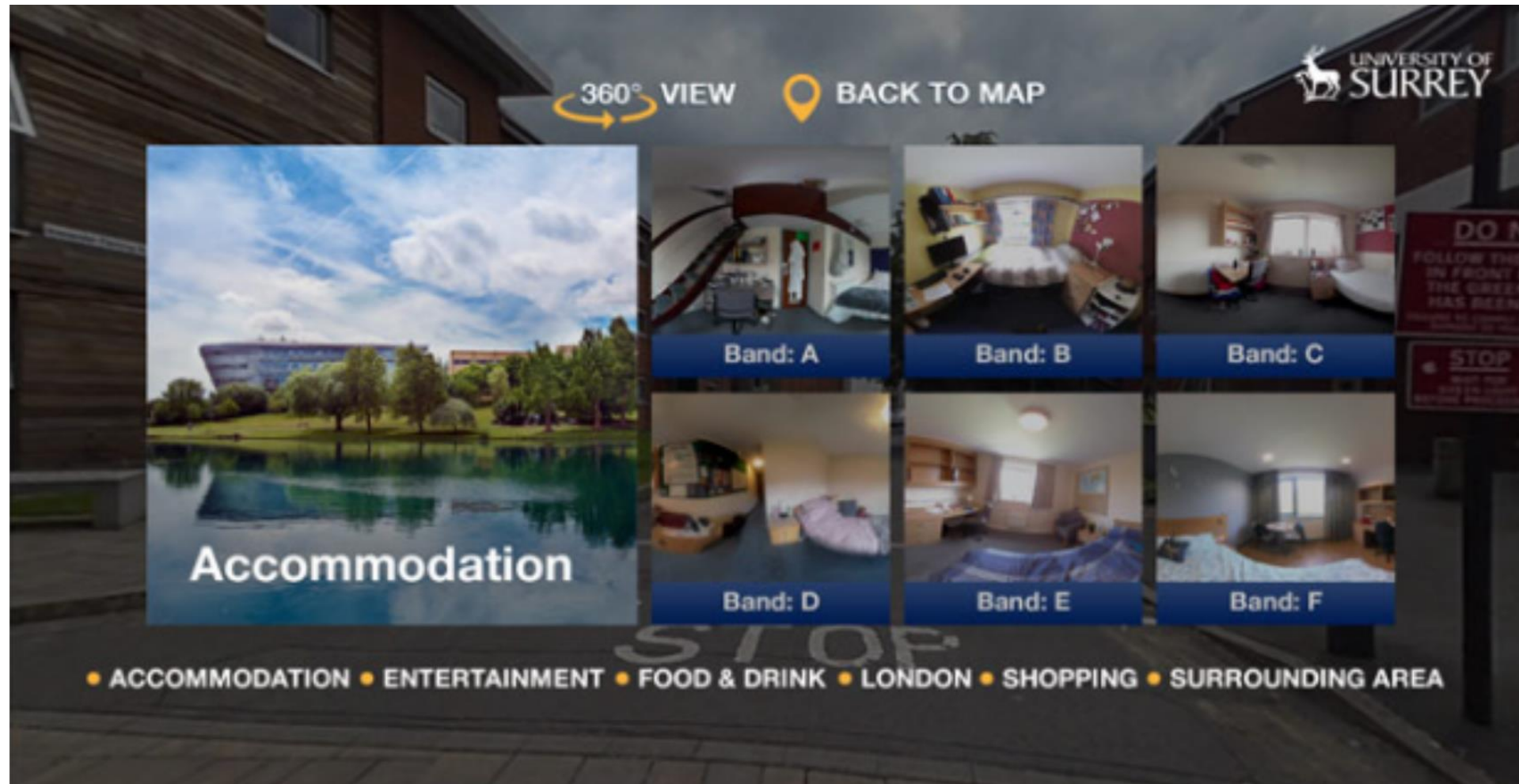
# Over 100 clubs and societies





# Accommodation

<https://www.surrey.ac.uk/accommodation> and virtual tour app



# Exploring Surrey – Guildford is only 34 minutes from London

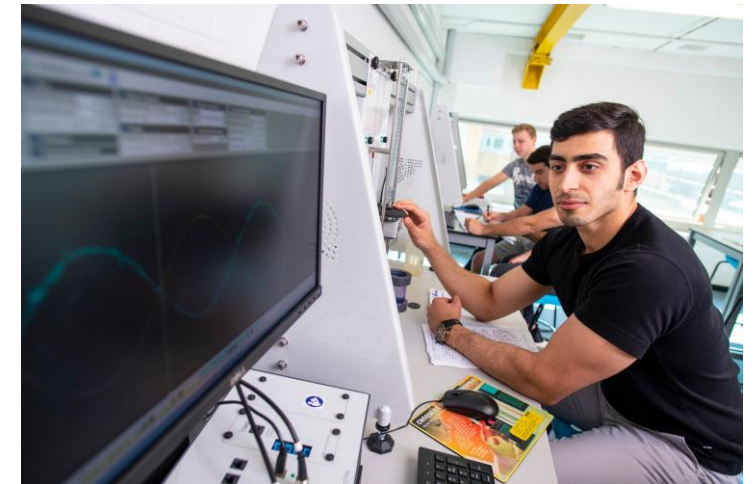




# Why Mechanical Engineering Sciences?

» *The department in numbers*

- » ~40 academic staff; 18 research fellows;
- » 7 technical staff and 4 administrators
  
- » **~750 undergraduates studying:**
  - BEng/MEng Aerospace Engineering
  - BEng/MEng Automotive Engineering
  - BEng/MEng Mechanical Engineering
  - BEng/MEng Biomedical Engineering
  
- » **~30 full-time PGT students studying:**
  - MSc in Biomedical Engineering
  
- » ~30 PhD and ~20 EngD research students





# Research at Surrey



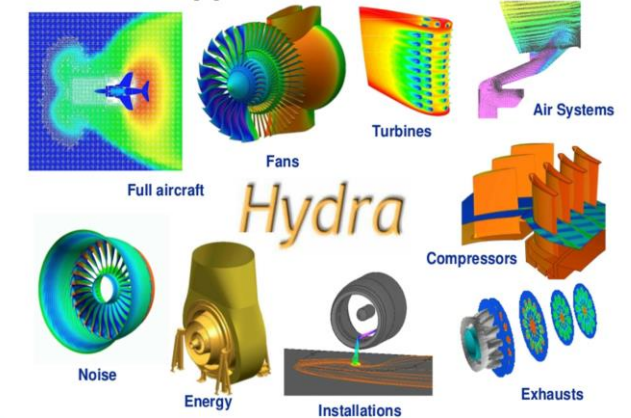
# Mechanical Engineering Sciences

» *Engineering is about making the world a better place.*

## Centre for Aerodynamics & Environmental Flow

- » Part of the Rolls-Royce network of research centres – Thermo-Fluid Systems University Technology Centre, which was established in 2003.
- » EnFlo, the Environmental Flow Research Centre, opened in 1993 as a focus for UK research activities based on laboratory scale simulation of atmospheric flow and pollutant dispersion. Its unique capabilities are recognised by its status as a NERC-NCAS (National Centre for Atmospheric Sciences) facility.

### HYDRA Applications



© 2008 Rolls-Royce plc

ICFD 25th Anniversary Meeting, 15-16 September, 2008



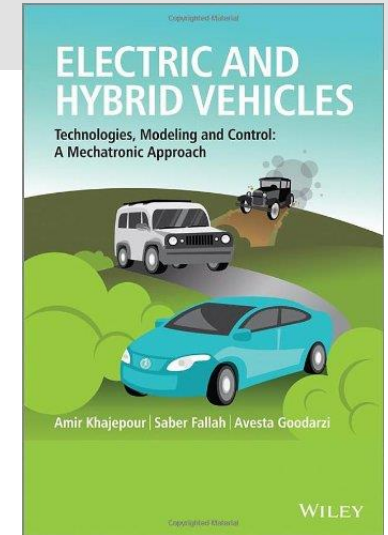


# Mechanical Engineering Sciences

» *Engineering is about making the world a better place.*

## » Centre for Automotive Engineering

» The group has research interests in hybrid vehicles, vehicle dynamics and control, and terrestrial mobile and space robotics. We are working with colleagues in the 5G Innovation Centre on autonomous driving.



» The group also oversees the Formula Student activity.



# Mechanical Engineering Sciences

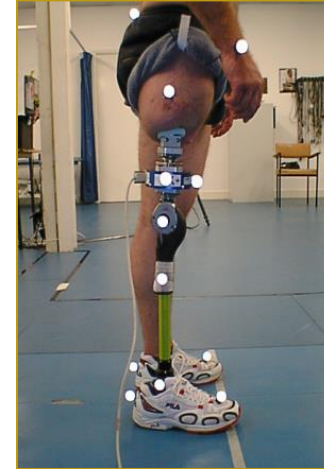
» *Engineering is about making the world a better place.*

## Centre for Biomedical Engineering

- » We are working with amputees to develop better outcomes, developing equipment and technologies to give early detection of cancer and Alzheimer's disease.

## Centre for Engineering Materials

- » Our activities range from saving lives through better armour to designing and manufacturing bespoke miniature energy harvesting devices for the internet of things.
- » Home to the EPSRC Centre for Doctoral Training in Micro- and NanoMaterials and Technologies



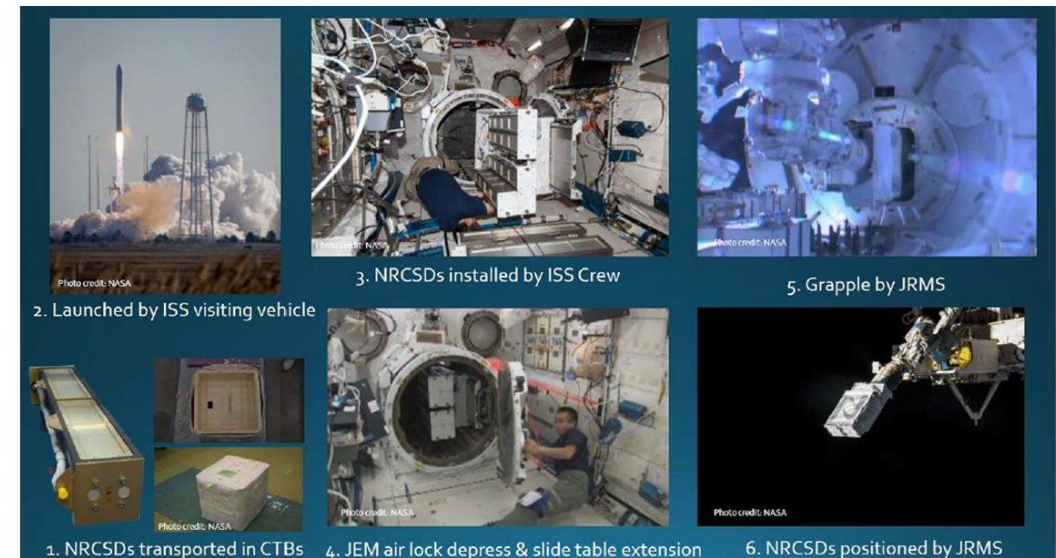
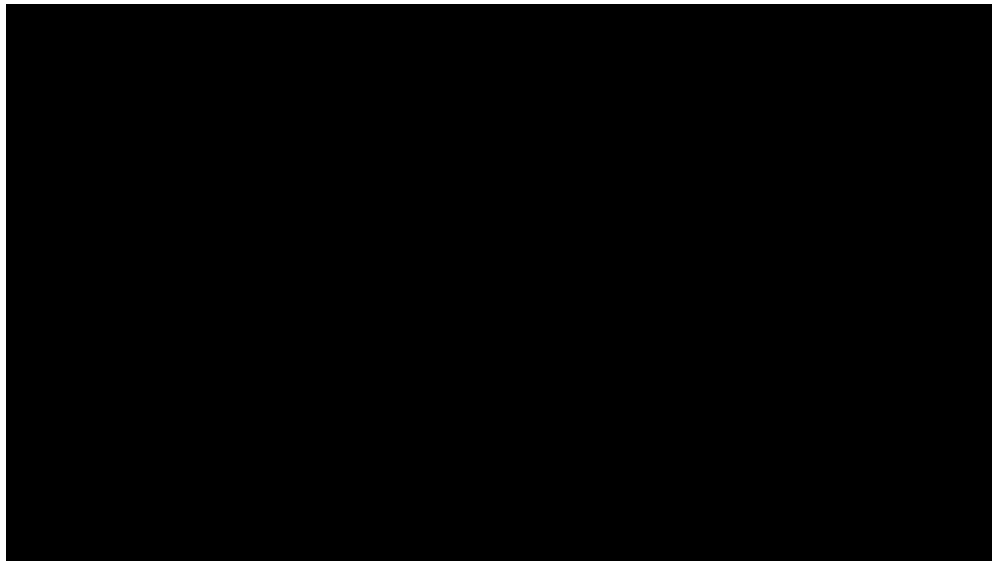


# Mechanical Engineering Sciences

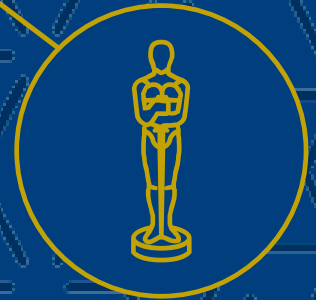
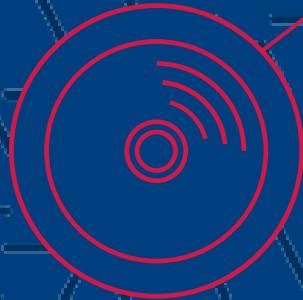
» *Engineering is about making the world a better place.*

## Surrey Space Centre

- Pioneers of modern "Small Satellites" since 1979, we have taken part in numerous missions. Spacecraft technology requires a broad range of backgrounds from Physics and Engineering to Mathematics and Software systems, this broad range is reflected in our research.

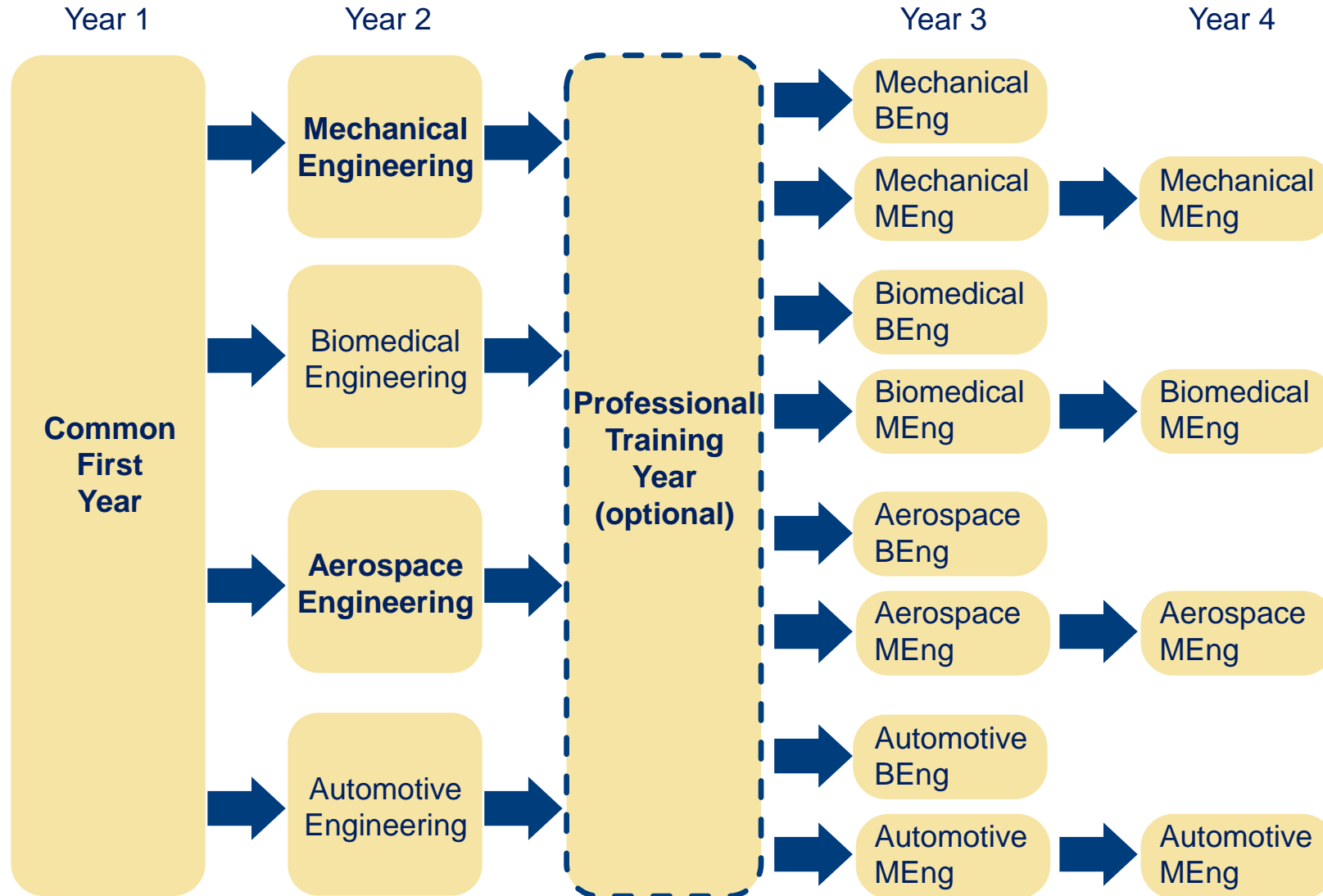


# Automotive and Mechanical Engineering Programmes





# Programme organisation



# Degree Programmes

## *Choosing between MEng and BEng*

**MEng**    *Master of Engineering, 4 or 5 years*

- More analytical: greater breadth and depth in support of R&D roles
- Fastest route to chartered status
- Fuller preparation for the workplace

**BEng**    *Bachelor of Engineering, 3 or 4 years*

- Fastest degree completion
- Shortest path to industry
- Good if you're planning a further degree such as a specialist M.Sc. or M.B.A.





# Programme Detail

## » Common First Year

### Year 1 (FHEQ level 4)

Modules include:

- Mathematics 1 and 2
- Experimental and Transferable Skills
- Fluid Mechanics and Thermodynamics
- Materials and Statics
- Design and Component Production
- Solid Mechanics 1
- Electronic Instrumentation 1

## Later Years

### Year 2+ (FHEQ level 5+)

Modules include:

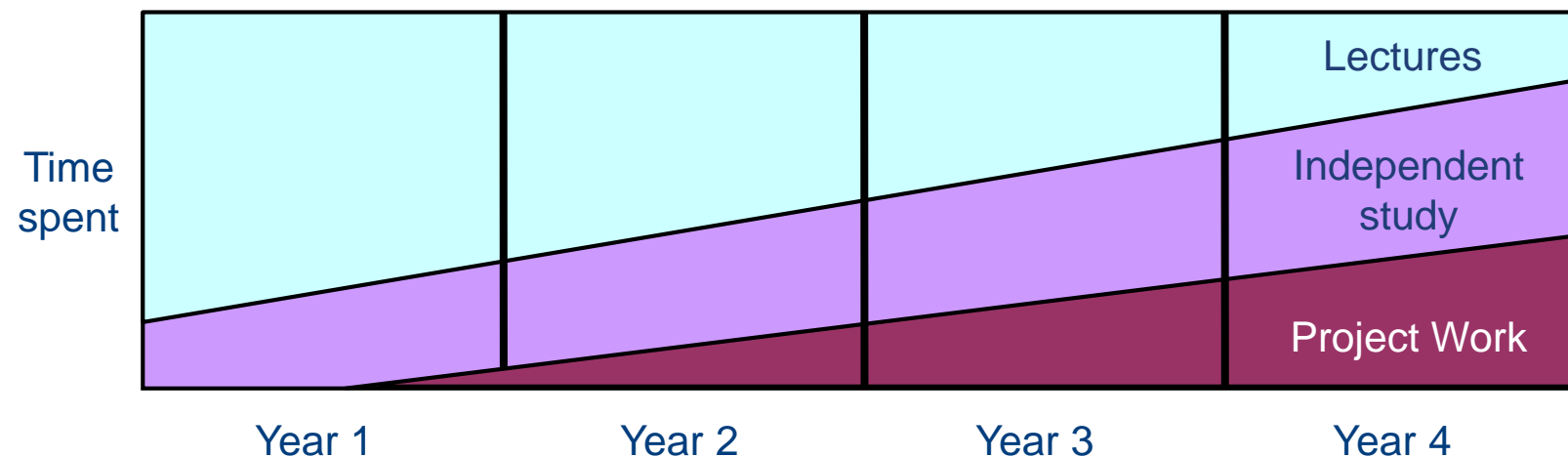
- Control & Dynamics
- Modern Vehicle Design
- Numerical and Experimental Methods
- Vehicle Aerodynamics
- Turbomachinery and Aircraft Propulsion
- Spacecraft Structures and Mechanisms
- Space Systems Design
- Composite Materials Technology
- Mechanics of Vehicles & Machines
- Advanced Stress Analysis

*You will be enrolled in 120 credits of modules each year. This roughly equates to four modules per semester.*

# Learning and Teaching

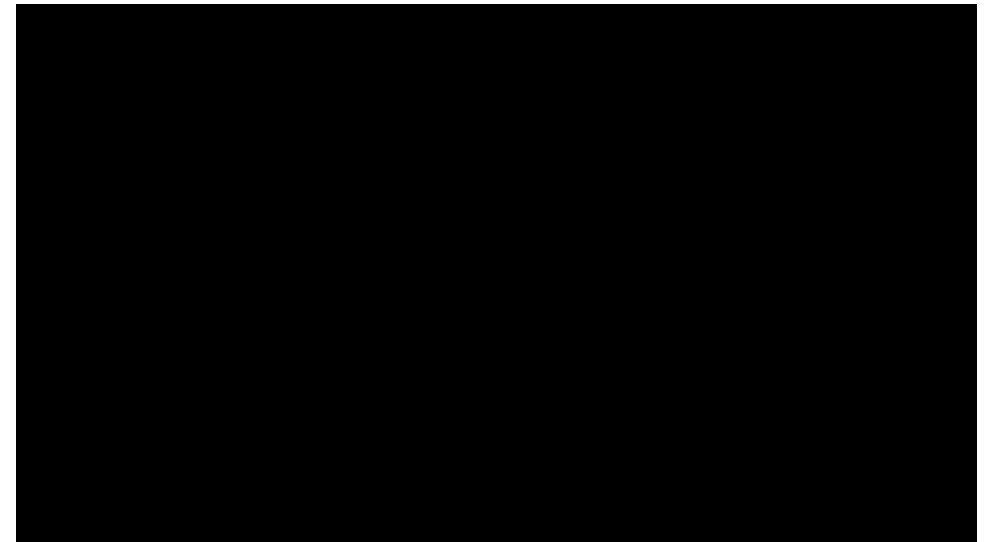
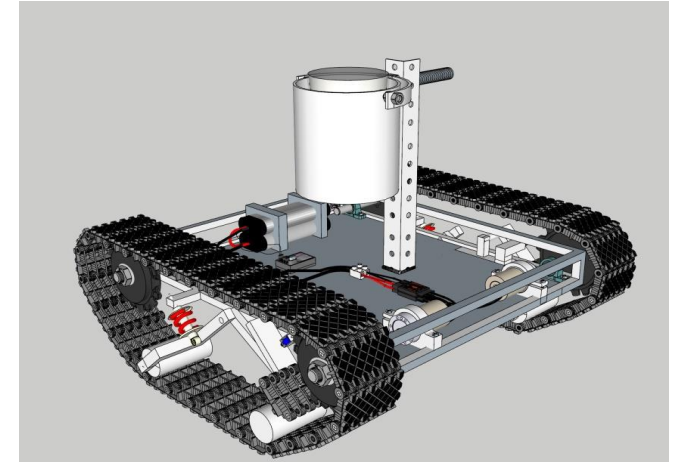
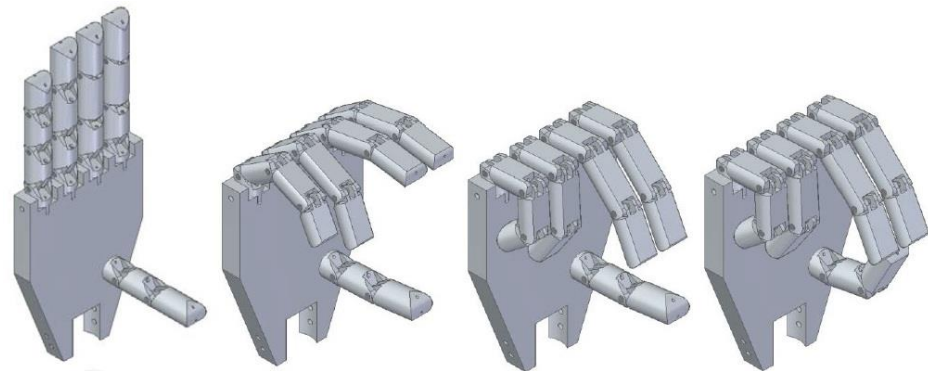
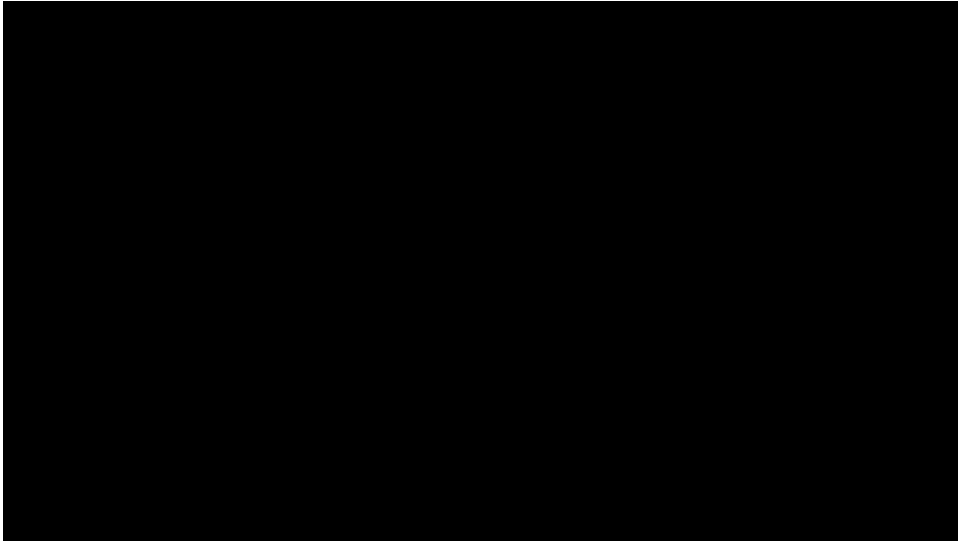
## » Learning and Teaching is by a Variety of Approaches

- Lectures
- Workshops and laboratory work
- Team design projects
- Virtual learning environment



# Programme Detail

» Year 2 Design Project (Group Project: Design, Make, and Evaluate)

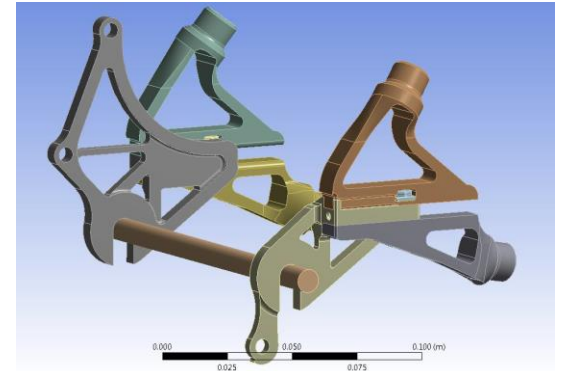




# Learning and Teaching

» *Individual Projects: Some current titles-*

- *Adaptive Mission Management Systems for Autonomous Vehicle Driving*
- *Decision Making for Autonomous Vehicles in Merging Situations*
- *Design of an Integrated Vehicle Health Monitoring Systems*
- *Effect of the understeer characteristic on the energy consumption of a fully electric vehicle with multiple motors*
- *Design of an optimal omnidirectional velocity probe*
- *Fuel cell heat transfer optimisation*
- *F1 rear wing aerodynamic study*
- *Ducted fan propulsion installation*
- *Hot gas ingestion in turbine air systems*
- *Design and modelling of vibrating piezoelectric energy harvesters*
- *Mechanical properties of metal-polymer composite materials for space applications*
- *Harpoon Target Deployment Device for In-orbit Demonstration*



# Formula Student (IMechE competition)

**University of Surrey -  
Formula Student team**  
(since 2008)

Participation possible from  
Day 1 through FS Society



# An exciting new activity

## IMechE Unmanned Aircraft Challenge





# Advantages of a Surrey degree

## Teaching quality is our priority:

- » You are our future!



## Focus on graduate employability:

- » One of the very highest graduate employment rates

## Programmes are fully accredited

- » Institution of Mechanical Engineers
- » Royal Aeronautical Society



## Integrated professional training

- » For those things you just can't learn in a lecture



# Global Graduate Award



- Arabic
- British Sign Language
- Chinese Mandarin
- French
- German
- Italian
- Japanese
- Korean
- Portuguese
- Russian
- Spanish

- Free language courses open to all students.
- Sustainability module.
- Starts every year in October and run for 19 weeks, two hours per weekly session, over two semesters.
- Are assessed modules, and the final module mark is based on assessed coursework tasks (60%) and a final test (40%).
- Award 15 co-curricular credits to undergraduate students which will appear on UG student records.

# Professional training year

- Normally done between second and third year of study
- Salaried positions: typically £16K - £21K
- Substantially reduced student fees during placement year
- A member of academic staff visits the student on-site
- Placements made at more than 100 companies in UK & overseas

ATKINS



**MBDA**  
MISSILE SYSTEMS



QinetiQ



Tyco  
Electronics

NSK



[dstl]



DEMATIC



Applus<sup>+</sup>  
IDIADA

SIEMENS





# Our students

◆ *Roshan Khinder, MEng Automotive Engineering*

## Frazer-Nash Manufacturing Placement

- Design, manufacturing and precision engineering
- Focus on food industry
- Manufacture parts for aerospace companies
- Produce bespoke machined parts for specific purposes
- Investment in Additive manufacturing

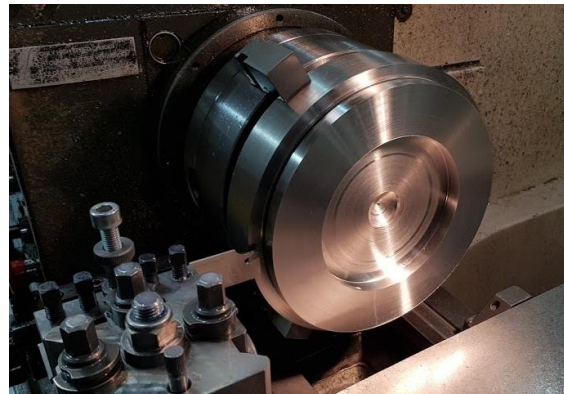


# My Roles

- Junior engineer
- Using lathe and 3-axis CNC mill
- Managing production projects and F4E project
- Assembling equipment and modifying parts
- Detailing drawings and modeling with CAD software
- Worked on real projects

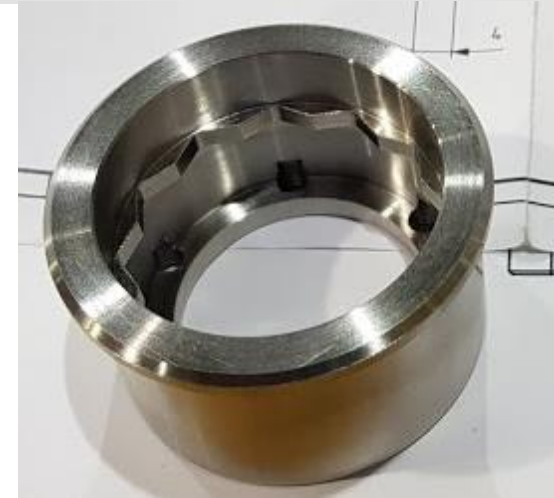
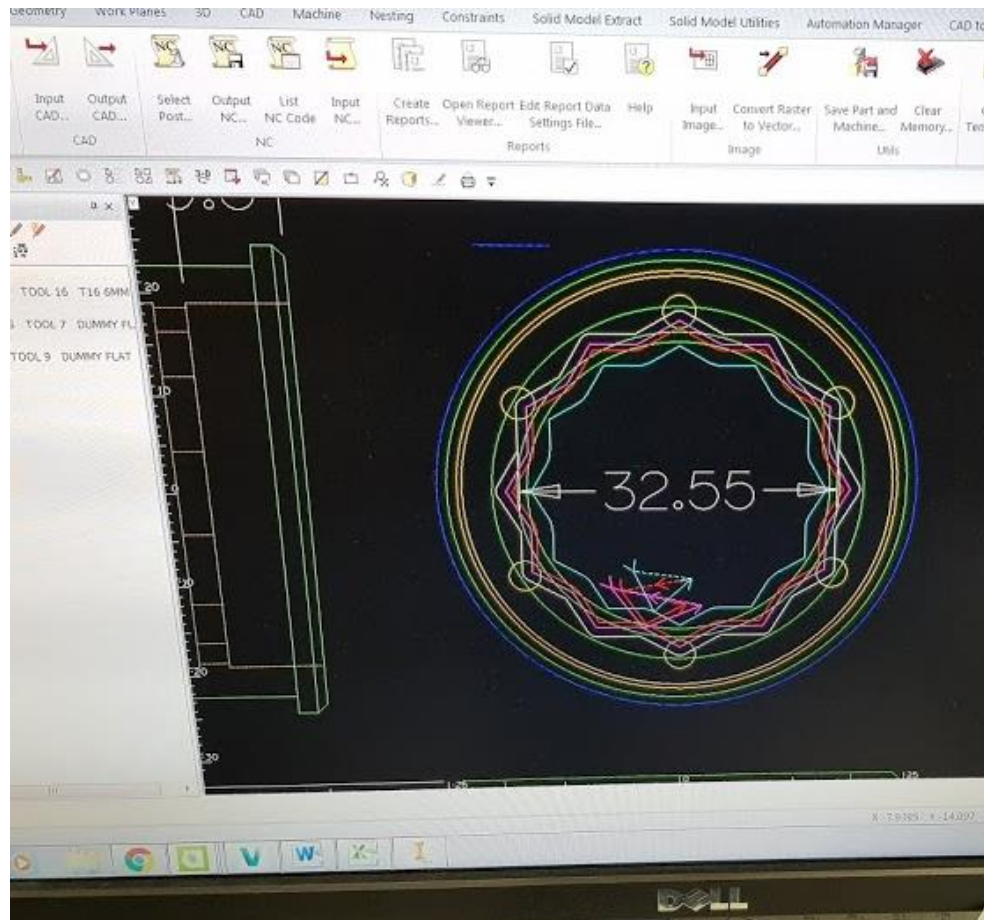
# Machining

- Started making basic components like washers and spacers
- Consistently achieved nominal values for tolerances
- Used more expensive materials: phosphor bronze, aluminium bronze, titanium
- 2<sup>nd</sup> op parts for more experienced turners
- More complex parts
- Screw cutting



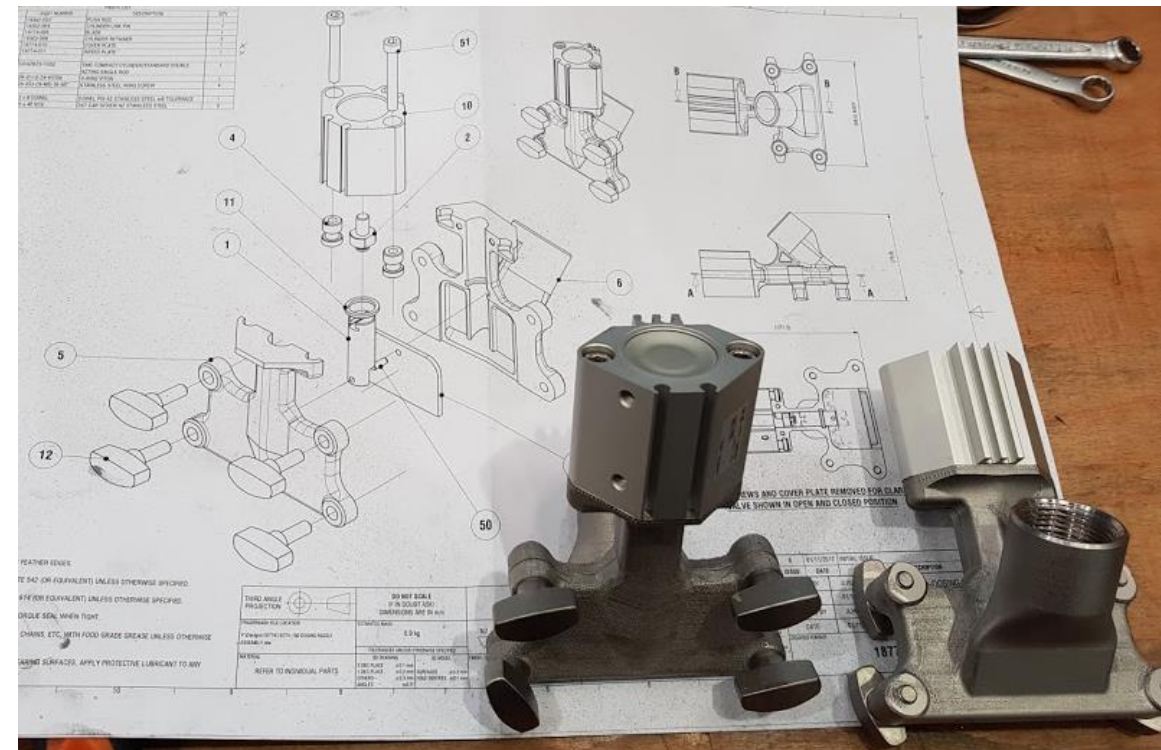


# CNC Milling



# Project Management

- Managed F4E project
  - Inspecting Eurofer-97 material
  - Writing report with findings
  - Log the material onto Winman
  
- Production management
  - Managing and tracking parts in production
  - Used Winman resource planning software
  - Projects: Grote, SSTL
  - Organising parts for assembly

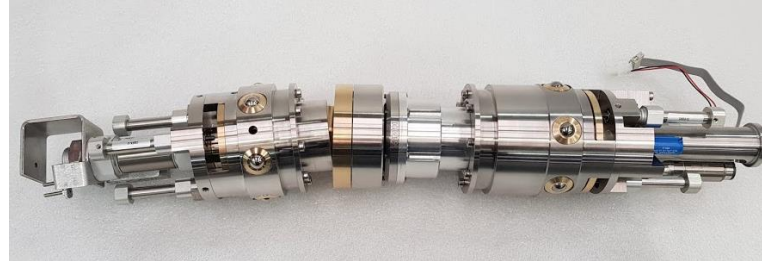


# Assembly

- Things to be aware of when fitting parts: anti-galling, bearing fits, reading assembly drawings
- Modifying parts
  - Turning and milling parts
  - Grinding and polishing
- Using modeling software to aid assembly
- Projects: 200Kg Mixer, Pipe welding tool, Guillotine, conveyor system, filler system



# Assembly



# Design

- Design a glove box for safe AM part cleaning
- Using Autodesk Inventor CAD software
- Worked on Mars Henderson design project
  - Detailed drawings
  - Designed component
- Fit tolerances and geometric tolerances
- Improved design practice

## Other parts

- Visited other companies while delivering parts to sub-contracted services (anodising, gun drilling, plating)
- Perfect bore factory tour
  - Scale for such a specific task
- Selective Laser Melting additive manufacturing





## Personal development

- Learned many practical skills used in engineering
- Understanding of machining limitations
- Design components that are easier and cheaper to manufacture
- Links from practical work to university modules
  - Materials, design, solid mechanics, project management
- Improved drive for learning

