

ENGINEERING EDUCATION IN A DISTRIBUTED UNIVERSITY

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Professor of Engineering

Royal Academy of Engineering VPs Conference, 26th September 2017

Contents

- **Background**
- **Engineering at the University of the Highlands and Islands (UHI)**
- **Institutional Support**



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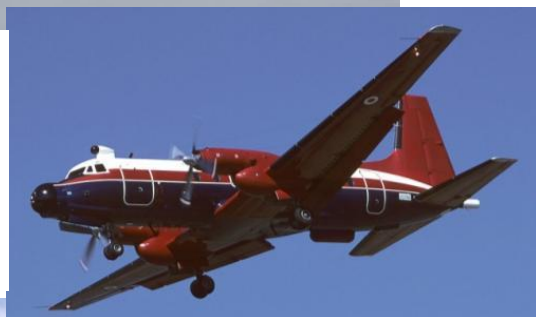
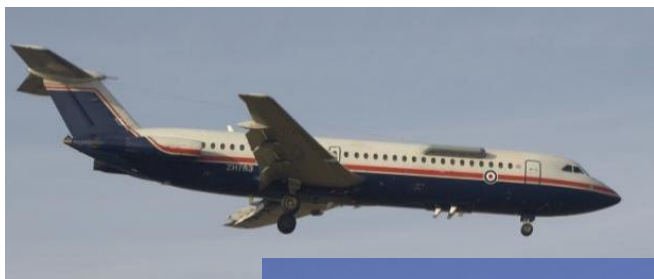
- **Background**
- Engineering at the University of the Highlands and Islands (UHI)
- Institutional Support



Background



Background



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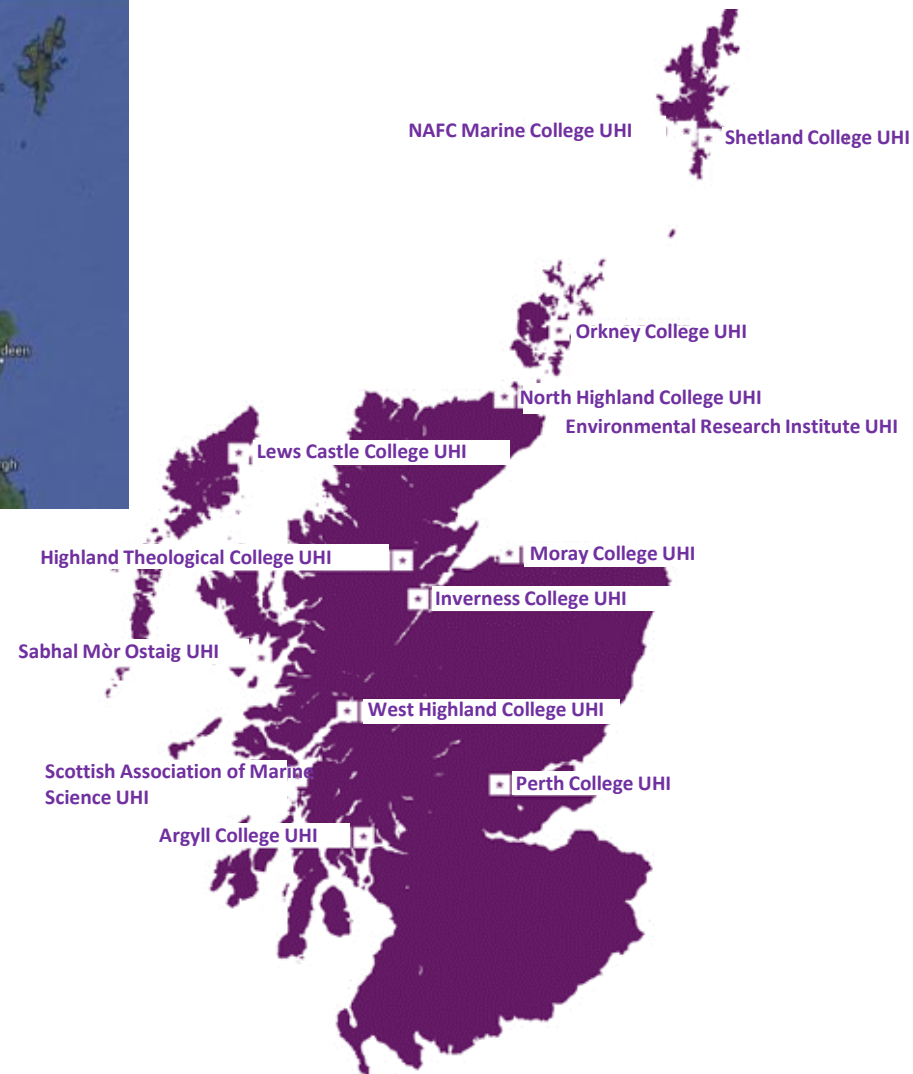
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Engineering at UHI

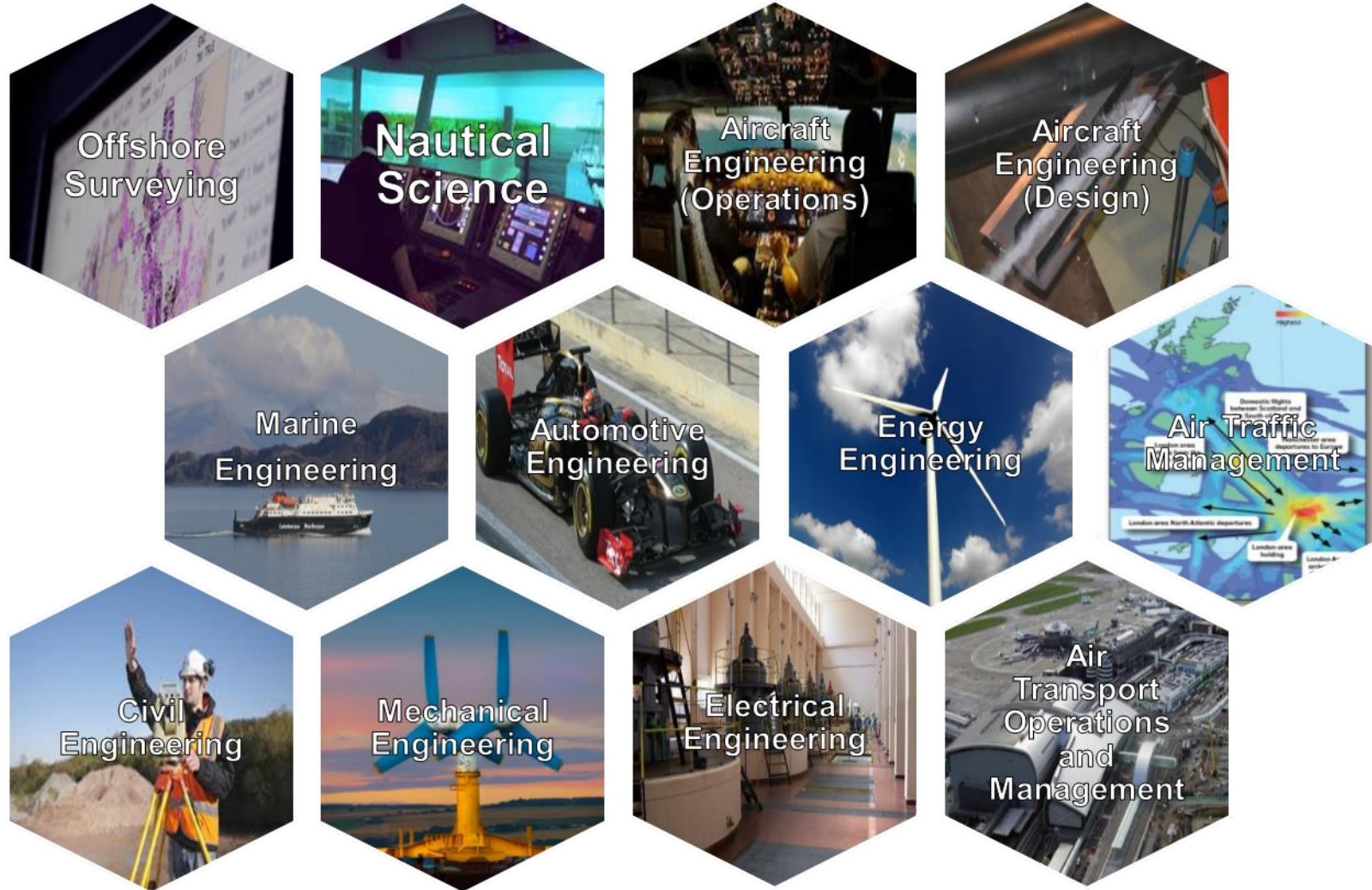


Engineering at UHI



- The University of the Highlands and Islands is the only university based in the Highlands and Islands of Scotland.
- It covers an area of ~240,00km².
- A partnership of 13 colleges and research institutions.
- 8000 students studying on undergraduate and postgraduate courses.
- Our Chancellor is HRH The Princess Royal.
- A **tertiary** institution: Schools, FE, HE and Research

Engineering at UHI



Engineering at UHI

Integrated Professional Training - Air Traffic Control

Full EASA Air Traffic Control Officers License

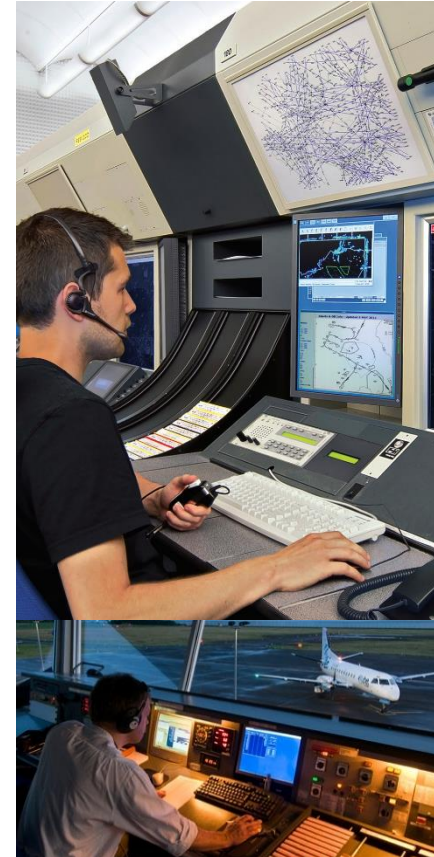
- Successful completion of the Full EASA Air Traffic Control Officers License at an EASA-approved academy.
- Practical elements to be undertaken within an approved Air Navigation Service Provider (ANSP).
- This maps to an equivalent Dip HE of 240 SCQF credit points at Level 8 with some aspects at level 9.

BSc Air Traffic Management (Y3)

- Aviation Regulation & Human Factors Management
- Aviation Business & Society
- Project Management
- Quality & Safety Management Systems for Aviation
- Aerodrome Operations & Management
- Quality & Safety Management Systems for Aviation
- Operational Management

BSc(Hons) Air Traffic Management (Y4)

- Air Transport Operation & Management
- Sustainable Management of Air Traffic
- Management of Risk
- Critical Incident Management & Emergency Planning
- Research Project/Dissertation



Engineering at UHI

Integrated Professional Training - Air Traffic Control

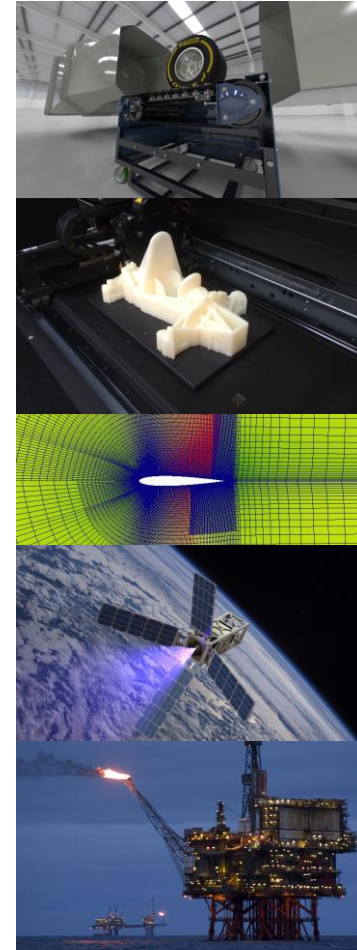
- Work-based learning.
- Work-based assessment.
- Crisis Management.
- Demonstrable Responsibility.



Engineering at UHI

Curriculum Design – Knowledge vs Skills

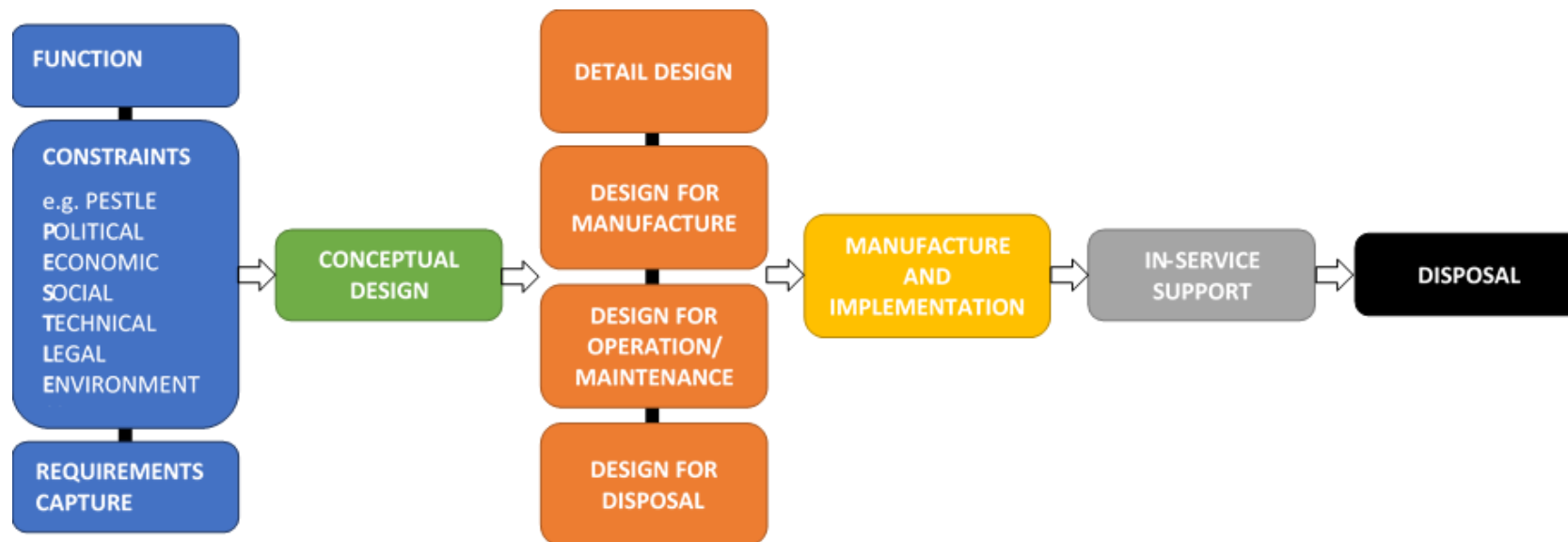
- Traditional Engineering Courses focus on knowledge.
- Now that ‘knowledge’ is more accessible, is there greater demand for ‘skills’?
 - Practical skills – workshop, CAD, numerical simulation (e.g. FEA, CFD), laboratory, etc.
 - Process skills – research methods, teamworking, project management, etc.
 - Which ‘tool’ to use, how to use it, how to understand the results.
- Vertically-Integrated Projects
 - An example – Lifecycle Management.
 - The ‘Design’ process is actually the same whether it is applied to an oil rig or a satellite.
 - The knowledge, constraints and scale vary, but the same skills are used.



Engineering at UHI

Curriculum Design – Knowledge vs Skills

- An example – Lifecycle Management.



- Including Design Reviews.

Engineering at UHI

Curriculum Design – Knowledge vs Skills

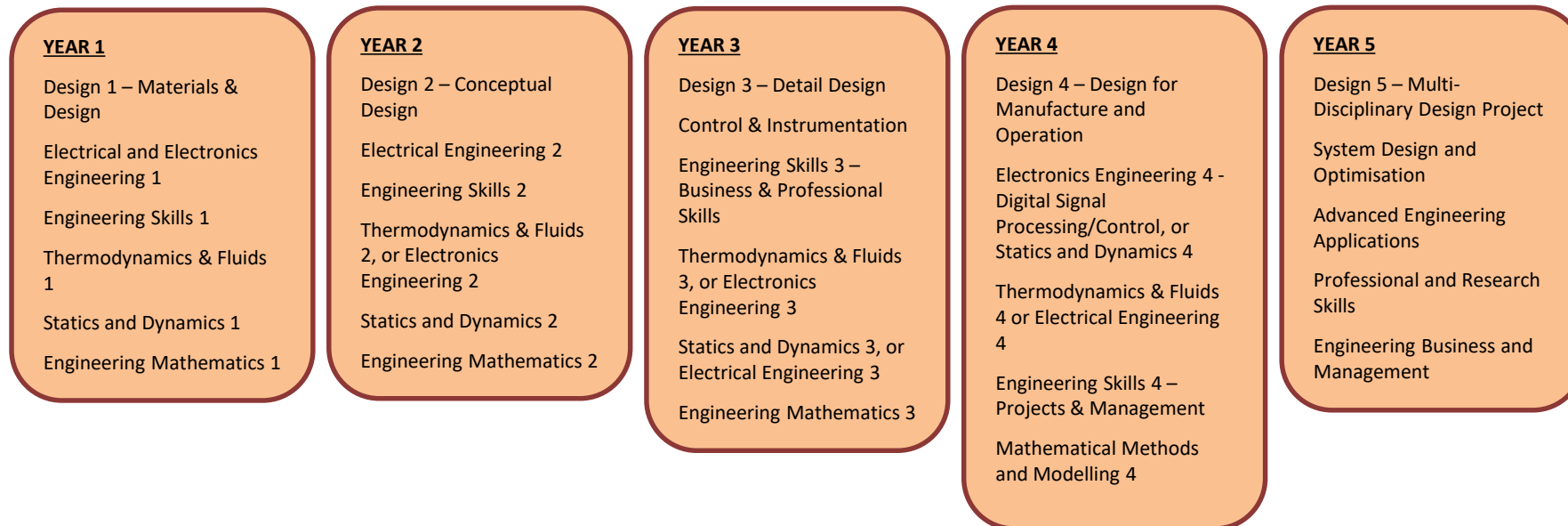
- An example – Lifecycle Management.

Purple Team	Assesses the probability of winning and alignment with organizational goals
Blue Team #1	Reviews initial capture strategy and capture plan
Black Hat Team	Predicts competitors' solutions
Blue Team #2	Reviews updated capture plan and solution set
Pink Team	Reviews storyboards and mock-ups to confirm solution set and to validate proposal strategy
Green Team	Reviews cost/price solution
Red Team	Reviews final proposal draft—including price—to predict how the customer will score the proposal
Gold Team	Approves final proposal and price
White Team	Compiles lessons learned from capture planning through proposal development to contract award

- How do you embed this within a curriculum?

Engineering at UHI

Curriculum Design – Vertically-Integrated Projects



- 5-Year Integrated Masters (MEng) in Engineering Design.
- Longitudinal development of themes (knowledge) with multi-disciplinary applications (skills).
- The 'T-Shaped' Graduate.



VS



Engineering at UHI

Curriculum Design – Vertically-Integrated Projects

YEAR 1

Design 1 – Materials & Design

YEAR 2

Design 2 – Conceptual Design

YEAR 3

Design 3 – Detail Design

YEAR 4

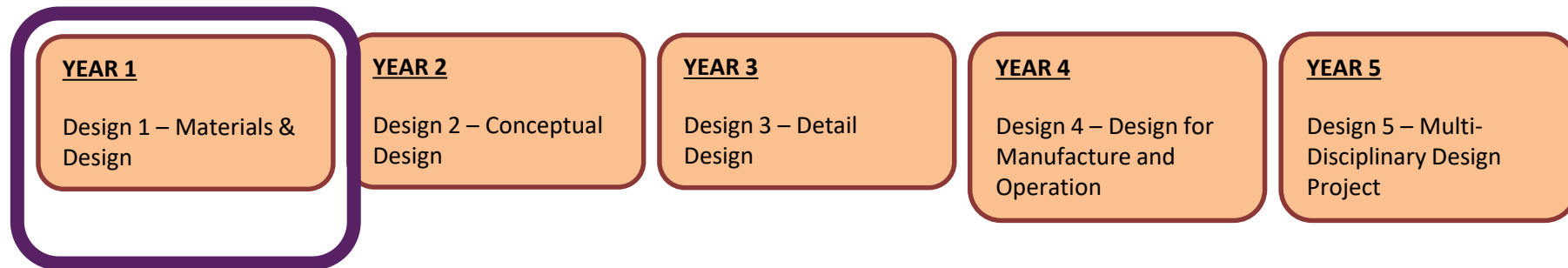
Design 4 – Design for Manufacture and Operation

YEAR 5

Design 5 – Multi-Disciplinary Design Project

Engineering at UHI

Curriculum Design – Vertically-Integrated Projects



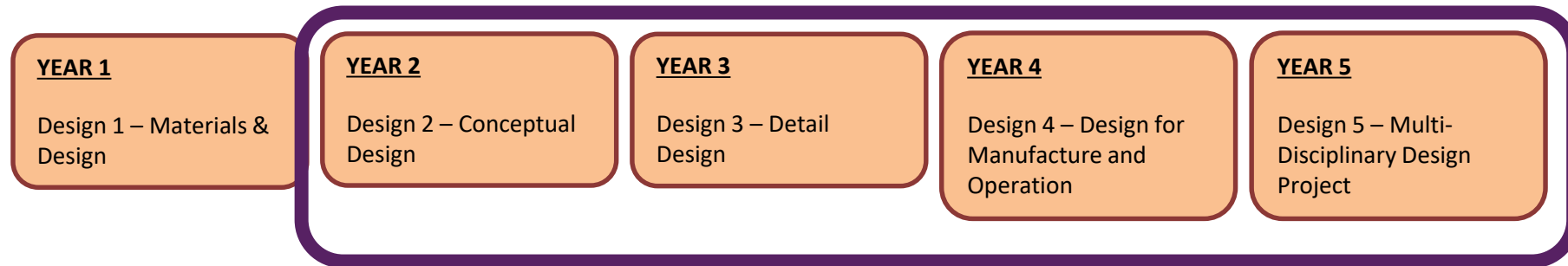
A small, self-contained group project, EWB for example.

Students get an overview of the full process.



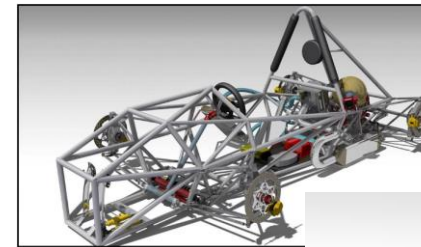
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Curriculum Design – Vertically-Integrated Projects



A large, multi-level group project, Formula Student for example.

Students have a different role each year.



**FORMULA
STUDENT**

Institution of
**MECHANICAL
ENGINEERS**



Engineering at UHI

Curriculum Design – Vertically-Integrated Projects

YEAR 1

Design 1 – Materials & Design

YEAR 2

Design 2 – Conceptual Design

YEAR 3

Design 3 – Detail Design

YEAR 4

Design 4 – Design for Manufacture and Operation

YEAR 5

Design 5 – Multi-Disciplinary Design Project

Year 5 students are the 'managers', Head of Aero for example.

Industrial and Academic Supervisors.

**FORMULA
STUDENT**

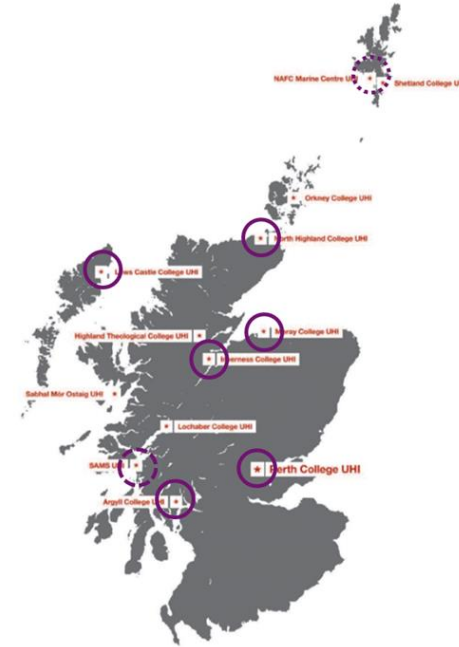
Institution of
**MECHANICAL
ENGINEERS**



Engineering at UHI

Curriculum Design – The Flipped Classroom

- Most of our undergraduate engineering qualifications are available to students studying at 5 partners within the university.
- This ‘networked’ delivery requires extensive use of video conferencing.
- Students can access from anywhere.
- Mimics modern multi-national working, but it can be a bit like an interactive YouTube channel.



Engineering at UHI

Curriculum Design – The Flipped Classroom

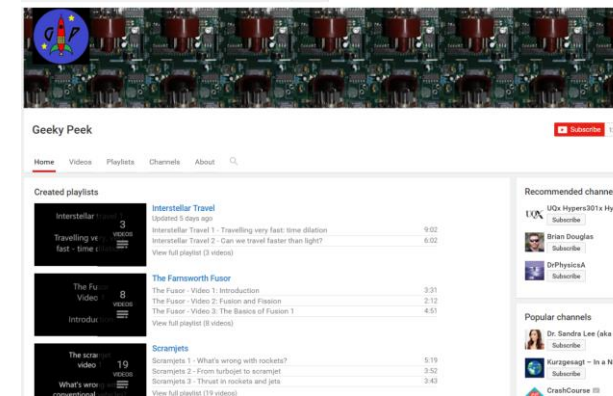
- Traditional teaching methods use face-to-face (classroom) time for knowledge download.
- Using a lecturer as a ‘talking textbook’ is exploiting fully neither their expertise nor their experience.
- By ‘flipping’ the classroom, the knowledge download happens outside of the classroom (homework) whenever and wherever the student chooses.
- Face-to-face time is used for tutorials, laboratories, field trips, etc.
- Students get a deeper understanding of concepts and make connections to content, easier to provide bespoke and timely student support.



Engineering at UHI

Curriculum Design – The Flipped Classroom

- The Flipped Classroom uses online repositories, like the VLE, to store digital artefacts:
 - Recorded lectures (maximum 10min segment);
 - Interactive webinars (e.g. Blackboard Collaborate, WebEx, Skype for Business);
 - Tutorials (e.g. ***Explain Everything***);
 - YouTube channels;
 - ***Problem-Based Learning*** assignments; and
 - Discussion boards.
- Ensure ***accessibility***



Engineering at UHI

Curriculum Design – Transferable Skills

- What attributes of an aeronautical engineer are in common with those of an automotive engineer?
- Of those, what are common with medical engineering?
- Engineering and Science?
- STEM and the Humanities?

Implementing Transferable Attributes and Skills within the Context of Degree Level Engineering Programs: Perceptions and Challenges, by Dr Patrick O'Donnell, Prof Andrew Rae, Dr Bassam Rakhshani and Robert Smith

The Adaptable Graduate by Dr Patrick O'Donnell, Prof Andrew Rae, Dr Bassam Rakhshani and Robert Smith in *Graduate Attributes in Higher Education: Attitudes on Attributes from Across the Disciplines* by Carey Normand, Lorraine Anderson (Editors)



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Institutional Support

Educational Development Unit (EDU)

Curriculum development

- Learning resources
- Problem-Based Learning
- Responsive HTML5 template
- Virtual tours
- Interactive maps
- Audio/ video
- Accessible pdf template
- VLE 'scaffolding'

Quality Improvement Activity

- Staff development

Pedagogical research

- eBook publishing
- 3D artefacts
- Augmented reality
- Resource builder tool



Institutional Support

EDU Resources

<http://showcase.uhi.ac.uk/>

Welcome to the Educational Development Unit (EDU) Showcase

University of the Highlands and Islands
Oilthigh na Gàidhealtachd agus nan Eilean

The Herald HIGHER EDUCATION AWARDS
in association with UWS UNIVERSITY OF THE WEST OF SCOTLAND

WINNER

Educational Development Unit, University of the Highlands and Islands
Academic Support Team of the Year 2016

Contact us at: edu@uhi.ac.uk

View samples of our resources by clicking on the bookshelf items. Resources displayed in tablets are fully optimised for viewing on portable devices.

<http://induction.uhi.ac.uk/>

<http://showcase.uhi.ac.uk/resources/ASP2/VC08/index.html>

<https://sketchfab.com/models/4d3568a6ecb2473ba83292bb66621440>

Institutional Support

The Learning and Teaching Academy (LTA)

- Informing our own practice.
- Cascading our practice.
- Contributing to knowledge.
- Advancing knowledge.



LTA forum

[Introducing the LTA forum and its members](#)

Research and scholarship

Supporting staff to become [research-informed, evidence-led and research active](#)

ALPINE

[Accredited Learning, Professional development and Innovation in Education](#)

The Learning and Teaching Academy (LTA) is a hub for the enhancement of learning and teaching within the university in the key areas of practice, scholarship and research, and strategy and policy.

The activities of the LTA support the development and sharing of excellent practice and engagement in pedagogic scholarship and research, through collaborative working and consultation, professional development opportunities, and providing funding and resources to support the development and embedding of effective and innovative pedagogical approaches.

Find out more about the LTA.

Contact us - lta@uhi.ac.uk

LATEST ACTIVITY

[Seeking Professional Recognition through ALPINE](#)
LTA Events 22/06/2016

[Managing blended learning in creative ways - the development of the virtual residency and international collaborations](#)
LTA Events 16/06/2016

[Frameworks for enhancing how we use Virtual Learning Environments \(VLEs\)](#)
LTA Events 10/06/2016

[Thinking about Open](#)
LTA Events 26/05/2016

[@musicsheridan @LTA_UHI @smythkrs @ThinkUHI looks like useful day, treat curriculum as a research problem #designthinking #coproduction IMHO](#)

<https://www.uhi.ac.uk/en/learning-and-teaching-academy>

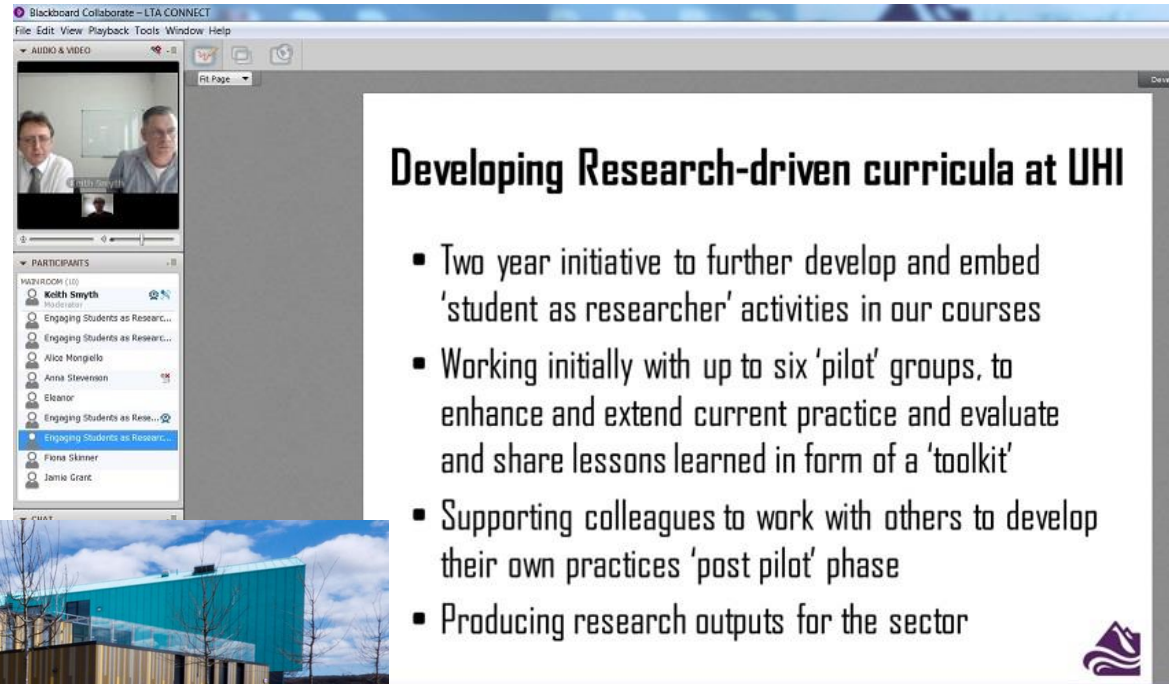


Institutional Support

LTA Connect

- Webinars and Online Seminars

Learning Lab



Developing Research-driven curricula at UHI

- Two year initiative to further develop and embed 'student as researcher' activities in our courses
- Working initially with up to six 'pilot' groups, to enhance and extend current practice and evaluate and share lessons learned in form of a 'toolkit'
- Supporting colleagues to work with others to develop their own practices 'post pilot' phase
- Producing research outputs for the sector



