Programme Specification

A statement of the knowledge, understanding and skills that underpin a taught programme of study leading to an award from The University of Sheffield

1	**Programme Title**	Aerospace Engineering
2	**Programme Code**	AERT04
3	**JACS Code**	H400
4	**Level of Study**	Postgraduate
5a	**Final Qualification**	Master of Science (MSc)
5b	**QAA FHEQ Level**	Masters
6a	**Intermediate Qualification(s)**	PGDip (AERT05) and PGCert (AERT06)
6b	**QAA FHEQ Level**	Honours
7	**Teaching Institution** (if not Sheffield)	Not applicable
8	**Faculty**	Engineering
9	**Department**	Interdisciplinary Programmes
10	**Other Department(s) involved in teaching the programme**	Automatic Control and Systems Engineering Computer Science Electronic and Electrical Engineering Management Materials Science and Engineering Mathematics and Statistics Mechanical Engineering
11	**Mode(s) of Attendance**	Full-time
12	**Duration of the Programme**	1 year
13	**Accrediting Professional or Statutory Body**	We will seek accreditation from: Royal Aeronautical Society (RAeS) Institution of Engineering and Technology (IET) Institution of Mechanical Engineers (IMechE) Institute of Materials, Minerals and Mining (IoM^3)
14	**Date of production/revision**	May 2018

15. Background to the programme and subject area

Aerospace engineering is a complex, rapidly changing field. Its primary application is the design and development of flight vehicles such as aircraft, spacecraft, rockets and satellites. Graduate aerospace engineers can look forward to a career in the leading organisations in the sector, including companies that have significant involvement in our programmes.

Aerospace Engineering at Sheffield differs from conventional aeronautical engineering degrees, which traditionally focus on the materials, structures, aerodynamics and propulsion necessary in the design of high-speed flight and lightweight aircraft. Our degrees cover all these topics but also address concepts of systems integration and autonomous control that are essential to the production of more efficient and environmentally-friendly aircraft and aerospace systems. This means that our students study avionics, dynamic control, information and communication technology, software integration and computer-based tools, in a curriculum that draws on the expertise of six departments in the Faculties of Engineering and Science, plus the University's Management School. Our unique test facilities include wind tunnels, jet-aeroengine simulators, an engine test bed and a suite of flight simulators to support their theoretical understanding of flight.

Another distinctive feature of our degrees is that at the same time as providing a breadth of knowledge, students can tailor their studies to suit their individual interests and career aspirations. Our MSc Aerospace Engineering degree offers the opportunity to specialise in-depth in either (i) an aeromechanics stream or(ii) an avionics stream. Throughout the degree, there are opportunities to participate in industrial seminars and to undertake research into real-life problems through a Group Design Project.

Our MSc Aerospace Engineering degree will satisfy the academic and practical requirements for the award of Chartered Engineer status. We will seek accreditation from the Royal Aeronautical Society (RAeS), the Institution of Engineering and Technology (IET), the Institution of Mechanical Engineers (IMechE) and the

Institute of Materials, Minerals and Mining (IoM³). Our students graduate equipped with the knowledge and skills they need to meet the challenges of working within this fast-moving engineering discipline and to succeed in their chosen career. Furthermore, due to the interdisciplinary nature of the degree our graduates are increasingly being recruited by the growing automotive sector as well as a wide range of other sectors including manufacturing, off-shore, energy and power, consultancy, education, research and finance.

16. Programme aims

The University's Mission is to provide students from a wide variety of educational and social backgrounds with high quality education in a research-led environment, delivered by staff working at the frontiers of academic enquiry. Aerospace Engineering at Sheffield implements this through its strong commitment to both teaching and research. It also aims to engender in students a commitment to future self-learning and social responsibility.

The overall aim of the degree is to admit intelligent and motivated students and, in a research-led environment, to create graduates who will become the future leaders and innovators in the engineering economy by:

1. providing teaching that is informed and invigorated by the research and scholarship of its staff and alert to the benefits of student-centred learning;
2. providing comprehensive knowledge and understanding of aerospace engineering systems, aerodynamics, propulsion, materials and structures, together with a more detailed and critical understanding in selected areas of aeromechanics or avionic systems;
3. developing in students' independence of thought, intellectual curiosity, ethical awareness and the business and management skills necessary for a professional engineer in aerospace engineering or a related field;
4. developing in students an extensive and diverse range of subject-specific and generic skills appropriate to graduate employment both within and outside aerospace engineering;
5. enabling students to maximise their potential and imparting in students a commitment to life-long learning;
6. providing an increased emphasis on industrial relevance. Individual project work and wide-ranging group design projects with strong industrial involvement give students first-hand experience of working alongside aerospace engineers and manufacturing engineers;
7. satisfying the academic and practical requirements for the award of Chartered Engineer status by meeting the latest accreditation requirements of the Engineering Council Accreditation of Higher Education Programmes (AHEP) in engineering, the RAeS, the IET, the IMechE and the IOM³.

As outlined in the University's Learning and Teaching Strategy, such a programme will prepare students for the world beyond the university through the innovative group design project as students from different backgrounds will be working across engineering boundaries.

17. Programme learning outcomes

Knowledge and understanding:	
By graduation students will have:	
K1	a comprehensive knowledge and understanding of aerospace engineering systems, aerodynamics, propulsion, materials and structures.
K2	a comprehensive knowledge and understanding of the mathematics necessary to apply engineering science to aerospace engineering.
K3	advanced knowledge and critical understanding in selected areas of aeromechanics or avionic systems.
K4	an understanding of the social and ethical awareness necessary for a professional engineer.
K5	a wide knowledge and understanding of the analytical and design processes and methods used in aerospace engineering and the ability to apply and adapt them in unfamiliar situations.
K6	a broad knowledge and understanding of management techniques and the different roles in a team and the application of these in engineering.
K7	an understanding of the use of information technology for analysis, design and management.
	For the award of PGDip and PGCert all of the above learning outcomes need to be achieved.

Skills and other attributes:	
By graduation students will be able to:	
S1	use engineering science, mathematics and information technology to analyse both familiar and unfamiliar engineering problems.
S2	demonstrate skills in the acquisition, use and critical evaluation of experimental and other subject-related information.
S3	produce designs in a professional manner, both individually and in a collaborative team, taking account of technical, environmental, ethical and commercial considerations.
S4	display creativity and innovation in solving unfamiliar problems.
S5	exercise independent thought and judgement.
S6	conduct a technical investigation.
S7	design and conduct experimental investigations, and analyse and report the results.
S8	prepare technical sketches and drawings, using hand or computer methods as appropriate.
S9	use appropriate computer aids for analysis and design in order to solve engineering problems and be aware of their limitations.
S10	demonstrate that they have completed the practical engineering applications necessary for a Chartered Engineer.
S11	prepare technical reports and presentations, and convey essential information using a variety of media.
S12	demonstrate that they have completed basic flight instrumentation tests.
S13	use information technology effectively.
S14	communicate at a professional level, orally, in writing and through visual presentations.
S15	work in collaboration with others to produce a significant engineering outcome.
S16	manage both group projects and their own time effectively.
S17	find information and learn independently.
For the award of PGDip S1, S3, S4, S5, S7, S8, S9, S11, S12, S13, S14, S15 and S16 will apply to the award. For the award of PGCert S1, S5, S8, S9, S12, S14, S15 and S16 will apply to the award.	

18. Teaching, learning and assessment

Development of the learning outcomes is promoted through the following teaching and learning methods:

- **Lectures:** The principal means of transmitting academic material and analysis techniques. Most lecture courses provide tutorial sheets to enable students to develop their understanding of the subject matter and methods during their private study.
- **Laboratory Classes:** These introduce experimental methods and provide a good opportunity for developing team-working and communication skills.
- **Coursework Assignments, Oral and Poster Presentations:** A number of modules have coursework assignments that require students to seek additional information and work on their own, or sometimes in small groups. They are designed to enable students to develop and show their understanding of the content of the module. Oral and poster presentations are included as part of some coursework assignments to provide opportunities for developing essential presentation and communication skills.
- **Tutorials and Example Classes:** These may be small group or up to class sized tutorials and are a main source of providing help to students to resolve problems in their understanding of course material.
- **Design Classes:** These enable students to work on ‘open-ended’ and often ill-defined problems related to real engineering situations. They also provide good opportunities for developing team-working and communication skills as well as individual skills.
- **Industrial and Research Seminars:** Seminars led by visiting industrialists and research academic staff take place throughout the degree. They enable students to develop their understanding of the industrial application of concepts they are learning in class, and of the role and responsibilities of a professional engineer.

- **Group Design Project:** This involves groups of typically 6-10 students working on an aerospace-related design. Additionally, it develops project management, time management, team-working and communication skills.
- **Individual Investigative Project:** It is an individual research and/or industrial project at the frontiers of engineering. It is completed under the supervision of a member of academic staff and provides an excellent opportunity for a student to pull together every aspect of their development during the degree.

Opportunities to demonstrate achievement of the learning outcomes are provided through the following assessment methods:

- **Written Examinations:** These are typically 2 hours in duration; many modules use this as the only or major assessment method.
- **Coursework Assignments, Oral and Poster Presentations:** Coursework assignments are widely used in design studies, computational exercises, laboratory reports, essays or other work designed to assess the understanding of the module. Assignments are mainly undertaken on an individual basis but are sometimes carried out in small groups. Some assignments use oral and poster presentations in order to assess the development of presentation and communication skills. Some modules use coursework assignments as the only or main method of assessment whilst others have this as a minor part with a written examination forming the major part of the overall assessment.
- **Class Tests:** These are small tests conducted during the main teaching periods to assess progress and understanding; they supplement more formal examinations and may take the form of online exercises or quizzes completed before and/or during a lecture, laboratory class or tutorial/example class.
- **Group Design Project:** It is assessed by (a) group reports and individual reports; (b) oral and poster presentations to a student audience and a panel of staff and industrial members of the Industrial Advisory Board where students respond to questioning from the panel; and (c) a flying session. The project is expected to be at a professional level.
- **Individual Investigative Project:** The project is assessed on the student's commitment and progress throughout the project, a written report, an oral presentation to a panel of staff and the response to questions from the panel. The project is expected to be at a professional level.

The main teaching, learning and assessment methods adopted for each learning outcome are shown below. In most cases a combination of methods is used.

							ASSESSMENT						
LEARNING OUTCOME (abbreviated - see Section 17 for full text) Items shown thus (•) are included depending on the nature of the project	Lectures	Laboratory classes	Coursework assignments, oral and poster presentations	Tutorials / examples classes	Design classes	Industrial / research seminars	Group design project	Individual project		Written examinations	Coursework assignments, oral and poster presentations	Class tests	Group design project	Individual project
K1 Broad understanding	•	•	•	•	•	•	•	•		•	•	•	•	•
K2 Mathematics	•	(•)		•			(•)	(•)		•	•		(•)	(•)
K3 Critical knowledge	•		•	•		•	(•)	•		•	•		(•)	•
K4 Professional responsibility	•		•	•		•	(•)	(•)		•	•		(•)	(•)
K5 Analytical/design methods	•	(•)	•	•	•		•	(•)		•	•		•	(•)
K6 Management techniques	•		•	•		•	(•)	(•)		•	•	•	(•)	(•)
K7 Information technology	•	•	•	•	•		(•)	(•)		•	•	•	(•)	(•)

S1 Analyse problems	•	•	•	•	•		•	•		•	•	•	•	•
S2 Acquire/evaluate data	•	•	•	•	•		•	•			•		•	•
S3 Produce designs	•		•		•		•	(•)			•		•	(•)
S4 Display creativity & innovation		•	•		•		•	•			•		•	•
S5 Exercise independent thought		•	•	•	•		•	•		•	•		•	•
S6 Conduct technical investigations							(•)	•					(•)	•
S7 Conduct experiments		•						(•)			•			(•)
S8 Prepare sketches / drawings	•		•		•		(•)	(•)			•		(•)	(•)
S9 Write computer programs	•	•	•				(•)	(•)			•		(•)	(•)
S10 Engineering applications	•	•	•		•						•	•		
S11 Prepare technical reports	•	•	•	•			•	•			•		•	•
S12 Flight instrumentation tests		•									•			
S13 Use IT effectively	•	•	•	(•)	•		•	•			•		•	•
S14 Communicate effectively		•	•	•	•		•	•		•	•	•	•	•
S15 Work collaboratively		•	(•)	•	•		•				•		•	
S16 Manage time effectively	•	•		•			•	•			•		•	•
S17 Learn independently			•				•	•			•		•	•

Proportions of types of assessment by level can be found on the UniStats website: http://unistats.direct.gov.uk/

19. Reference points

The learning outcomes have been developed to reflect the following points of reference:

Subject Benchmark Statement (Engineering)
http://www.qaa.ac.uk/en/Publications/Documents/SBS-engineering-15.pdf

UK Quality Code for Higher Education, 2014
http://www.qaa.ac.uk/en/Publications/Documents/qualifications-frameworks.pdf

The University's plan for the future http://www.sheffield.ac.uk/strategicplan

The University's Learning, Teaching and Assessment Strategy (2011-16)
http://www.shef.ac.uk/lets/strategy/lts

Annex to Academic Standards – Engineering: Annex B4 MEng degrees, Quality Assurance Agency for Higher Education

The Accreditation of Higher Education Programmes: UK Standard for Professional Engineering Competence, Engineering Council, third edition.
http://www.engc.org.uk/standards-guidance/standards/accreditation-of-higher-education-programmes-ahep/

Faculty-wide research activities (Faculty Aerospace Network)

Feedback from External Examiners and industrial members on the Aerospace Industrial Advisory Board

Requirements of the professional bodies accrediting our programmes: RAeS, the IET, the iMechE, the IoM^3

In assessing the learning outcomes, the level of performance, e.g. the extent of knowledge and depth of understanding, will be compliant with guidance given in the above references.

20. Programme structure and regulations

The degree structure is modular. Students study modules worth a total of 180 credits. Most modules are worth 10 or 20 credits, with one 60-credit Aerospace Individual Project module. Students pick one of two options; aerodynamics and propulsion or avionics.

Detailed information about the structure of programmes, regulations concerning assessment and progression and descriptions of individual modules are published in the University Calendar available on-line at http://www.sheffield.ac.uk/calendar/.

21. Student development over the course of study

Students will study, in depth, their chosen area of specialisation (e.g. propulsion/aerodynamics or avionics). Postgraduates are expected to be self-motivated, efficient and organised independent learners. They will undertake a group design project over two semesters. The project enables them to demonstrate their aerospace engineering knowledge, design abilities and also their project management, inter-personal and communication skills.

A third of the year is an individual investigative project in which students can demonstrate the full range of personal, communication and academic skills. It is assessed at the end the year through a report, the professional engineering skills displayed by the student during the project, and a viva voce at which students are questioned on their research by two members of academic staff. This assessment enables the student to demonstrate the level of their professional development as an aerospace engineer. The taught modules continue to be appropriate to the student's chosen elective, and allow them to specialise still further. Many of these modules are at the cutting edge of their discipline.

On successful completion of the programme: Students have obtained the necessary academic qualification and practical engineering applications experience to become a Chartered Engineer*. Full Chartered Engineer status requires appropriate experience working as a graduate engineer. Students will be well prepared for a career in aerospace engineering, other engineering sectors, the aviation/commercial airline industry and also a wide range of other graduate careers. They will be able to assess whether or not they have the ability, motivation and interest to pursue further postgraduate training in aerospace, or other engineering disciplines.

*this programme is yet to be accredited.

22. Criteria for admission to the programme

Detailed information regarding admission to the degree is available at http://www.sheffield.ac.uk/aerospace/prospectiveug/entry

Aerospace Engineering at Sheffield is suitable for well-qualified and motivated students. The admissions procedure is aimed at ensuring all new students meet the requirements for successful completion regardless of their educational or other background.

Applicants will require a 2.1 BEng degree in either Mechanical Engineering, Materials Science and Engineering, Automatic Control Systems Engineering, Electrical and Electronic Engineering.

We require an English language qualification with an IELTs of 6.5 overall and minimum of 6.0 in each component.

23. Additional information

Aerospace Engineering at Sheffield has an academic Director, who is responsible for overseeing the degree, and an administrative team who deal with its day-to-day running. They are all available to provide general help and advice on all aspects of the degree and university life.

The University and the Faculty of Engineering place strong emphasis on ensuring our graduates have all the attributes necessary for success in their chosen career. Students are assisted in their self-development and continuing professional development through activities embedded throughout the entire degree. This includes Careers events specifically for Aerospace Engineering students in each year of their degree, which provide career inspiration and guidance, and enable our students to meet potential employers and to refine their CVs and understanding of how to succeed in the application process. This reinforces the careers support available throughout the degree from the University's Careers Service (http://www.shef.ac.uk/careers/students) and from the Employability Hub in the Faculty of Engineering.