

The Universe of Engineering



Primary Engineer Programmes  
*...the first step*

Norfolk Proposal

Primary Engineer, Norwich and surrounding areas  
Academic Year 2018/19



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More generally, the University of Strathclyde is delighted to support the work of Primary Engineer not only in Scotland but across the UK. We consider it to be a significant game changer in the field of engineering education, addressing the issues of perception, gender, skills and engagement with STEM subjects. Their established methodologies of training, resource development and linking engineers to schools will, without question, have a dramatic effect on the future of engineering.

Yours faithfully



Professor Sir Jim McDonald  
Principal and Vice-Chancellor



We feel that the secrets of your success are twofold. Firstly that your ideas fit seamlessly and affordably into the curriculum. Secondly, that your training and involvement of teachers gives a lasting link for the schoolchildren with the content delivered. So often, STEM related interventions fail on this last point and hence become a one-off experience for children rather than create a lasting impression. Your offering of something for every year group at schools also means that the same pupils, and indeed sometimes with the same teachers, can engage in an ongoing series of related projects through the years.

We wish you every continuing success,



Dr Colin Brown  
Engineering Director



## Executive Summary

STEM is all around us, but the cry is still for a skilled workforce. The increasing demand for engineers and technicians is well documented by Engineering UK, Royal Academy of Engineering and Government. Professor John Perkins identified the 'leaky pipe' of talent lost to industry and business in the [Perkins Engineering Skills Report](#) 2013. In January 2015, he joined the Primary Engineer Advisory Board to champion that engineering has to begin earlier, much earlier, in fact in primary schools. In Scotland, the [Commission for Developing Scotland's Young Workforce](#) recommendations to industry was to link into colleges and schools but be aware of the important foundation required in primary schools.

As such Primary Engineer has built a world class reputation in engineering education, referenced throughout the Royal Academy of Engineering [Thinking like an engineer](#) research working closely with Professor Bill Lucas to expand the research base and develop pedagogies. We are included in the Scottish [Engineering Skills Investment plan](#) and [A Manufacturing Future for Scotland](#), funded by Skills Development Scotland and working across the UK with companies such as Babcock International, Rolls Royce, Ford, Siemens, Bosch, local and national government, Ministry of Defence and the Institution of Mechanical Engineers (IMechE).

Professor Sir Jim McDonald Principal and Vice Chancellor of Strathclyde University describes the programme as 'a significant game changer in the field of engineering education' due to the unique approaches, we have designed and deployed.

We are witnessing exponential growth patterns with demand for the wider programme not just training courses for teachers but the strategic development of engineering education including across whole regions such as in Burnley and East Ayrshire. In 2016 the programme worked with 1,700 teachers who taught curriculum based engineering projects to 56,000 pupils. In 2017 The University of Strathclyde accredited our Engineering STEM Postgraduate MA course which will enable teachers to develop strategies in the classroom based on direct interaction with engineers. This body of teacher-led research will enable the on-going development of our courses and evidence of impact. It was recently reviewed in the [General Teaching Council magazine](#)

The flag ship programmes that will draw together all STEM education both in the curriculum and extra-curricular and will have the greatest impact nationally and potentially internationally are the Institution of Primary Engineers® and the Institution of Secondary Engineers®. These two engineering institutions for children and young adults are significant game changers, developed as a solution to the need for skills in education.

Dr Susan Scurlock. CEO and Founder Primary Engineer Programmes

# Primary Engineer Programmes

Where confidence and skills in STEM are lacking in the teaching professional, pupils face a disengagement with these subjects from a very early age. Over the last twelve years Primary Engineer has responded to the demand by teachers and engineering companies to expand the programme from the first Primary Engineer training days to a comprehensive suite of training; sustainable, curriculum-mapped, whole-class activities, Master's Level professional development, celebration events and links to industry.



**EARLY YEARS ENGINEER®**

**Early Years Engineer®** Training courses and resources for teachers of 3-5 year olds addressing scientific investigation and providing opportunities to build transition links into primary school.



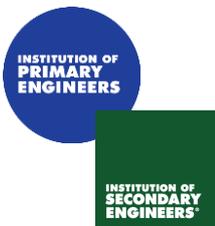
**PRIMARY ENGINEER®**

**Primary Engineer®** Training courses, resources and Celebration Events for all years of primary phase education. Projects include box modelling vehicle designs, paper engineering, electric vehicles, crane design, 3D printing, computer control and software engineering. Pupils work with engineers in the classroom and enter competitions and local celebration events to applaud pupils and teachers work.



**SECONDARY ENGINEER®**

**Secondary Engineer®** Two Key Stage 3 projects; The Aeronautical Enterprise Challenge, Secondary Engineer Bicycle Club and The Fluid Power Challenge. Both offer training courses for teachers from the STEM subjects – Science (physics), Maths and Design & Technology alongside engineers creating cross-curricular projects used in whole-class settings, wholly inclusive as part of the secondary curriculum. Schools engage in exciting design and make projects which support the study of STEM in a practical manner and give pupils the opportunity to work with engineers in the classroom and compete against teams from other schools.



The **Institution of Primary Engineers®** (IPrimEng) and **Institution of Secondary Engineers®**: (ISecEng) span across primary and secondary schools providing a methodology to map skills and competencies to the curriculum. Tracking pupils as they move from primary through secondary and into work or further education. They are effectively Professional Engineering Institutions for children and students between the ages of 5 and 18 years. Pupils and students gain membership, can apply for Chartership and Fellow status receiving the post nominals M.IPrimEng, M.ISecEng, C.IPrimEng, C.ISecEng and F.IPrimEng, F.ISecEng.



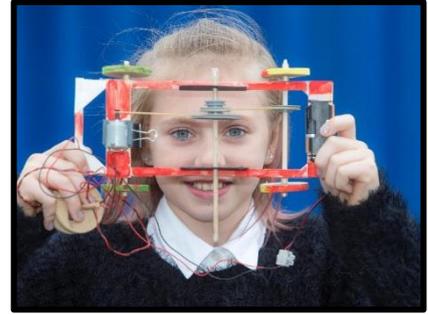
**IF YOU WERE  
an ENGINEER –  
What WOULD  
YOU DO?**

**Primary & Secondary Engineer Leaders Award:** A free to schools competition asking pupils what they would do if they could be an engineer. Pupils interview engineers, design and annotate a solution to a problem they have perceived, culminating in public exhibitions and awards evenings. Offered in Scotland (called the Scottish Engineering Leaders Award) Burnley, Greater Manchester, London, South England, South West England, East England, Central England and North East England. The awards are linked to universities where pupil's designs have been made by engineers.



**Master's Level Research:** Engineering STEM Learning is our PG Cert and Professional Recognition course accredited by both the University of Strathclyde and The General Teaching Council for Scotland. Teachers engage with the current STEM Landscape, interview engineers to understand more about their skills and motivation and develop action research to develop the Engineering Habits of Mind with their own pupils.

# Proposal

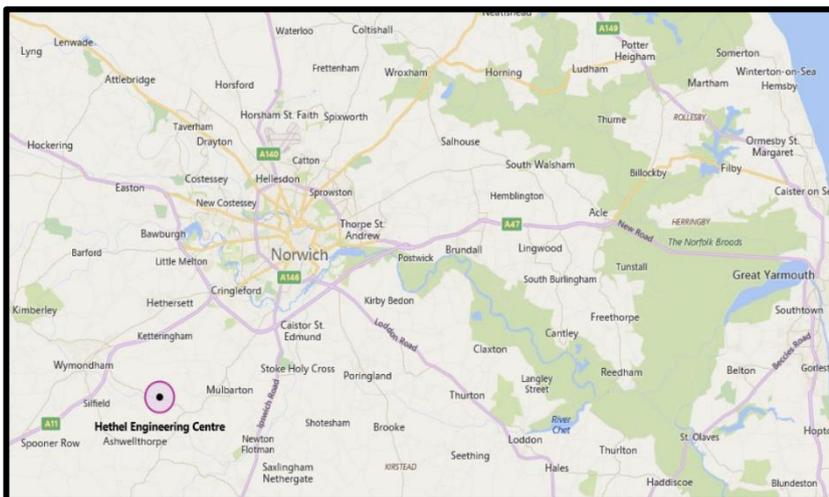


2018, is the Government Year of Engineering and in response to the need to develop STEM skills, principally engineering skills in young people and in particular, to address the need to engage primary pupils with engineering, this proposal is to provide the Primary Engineer Programme to schools in the Norwich area of Norfolk.

Primary Engineer Programmes establish strong education and engineering industry links, the foundation of which is based on training teachers and partnering schools with engineers. The engineers will be drawn from engineering industry partners and organisations such as the British Fluid Power Association (BFPA) the Institution of Mechanical Engineers (IMechE) and STEM Ambassadors via STEM Learning. The engineers will support the programme in the classroom with teachers and pupils, providing a real-world context to the learning. This engineering context offers children the opportunity to develop skills and behaviours through curriculum-linked engineering projects and meaningful engagement with engineers and increases the aspiration and career awareness of the teachers and pupils.

As the Primary Engineer model is to provide CPD training for teachers, this allows for the programme to be inclusive (all children are engaged regardless of gender, ethnicity or socio-economic background) and sustainable with trained teachers able to run the programme every year with a new group of children.

Primary Engineer Programmes have already secured engineering industry partner funding from the British Fluid Power Association (BFPA), Hethel Engineering Centre, Pangean Engineering, Proeon Systems and Ardagh Group, This proposal is for more companies to fund additional schools to enable them to undertake the programme.



Primary Engineer® Programmes  
...the first step



# Summary of Funded Programme

## Primary Engineer – Structures & Mechanisms with Basic Electrics

Primary Engineer has been delivering courses to schools across the UK for over twelve years. The programmes offer teachers opportunities to embed engineering skills in their teaching and learning through whole-class, curriculum mapped, engineering programmes.

The Primary Engineer Structures and Mechanisms with Basic Electrics offers whole-class projects for teachers and pupils in Key stage 1 and Key Stage 2 which provide opportunities for practical maths and science through engineering. The programme enables delivery of curricular areas through the engineering projects, importantly, maths, literacy and science and linking the project to learning themes enable teachers to develop practical and cognitive skills in pupils. As the programme is not a 'kit of parts' pupils have the opportunity to develop Engineering Habits of Mind (EHoM) and skills such as problem finding, problem solving, improving, adapting, visualising as well as team work and communication skills.

The Primary Engineer Programme will see teachers attend a one-day, practical CPD training course which will enable them to deliver the programme. Teachers will be provided with starter sets of tools and consumables to run the programme and will be given access to teaching and learning resources to support the programme via the Primary Engineer Virtual Learning Environment (VLE). Teachers will be partnered with engineers on the training course who will then support the programme in the classroom after. Following the teacher training days, teachers will run the Primary Engineer Programme during the academic year. At the end of the academic year, teams from the participating schools will be invited to a Primary Engineer Celebration Event and Competition.

### Aims:

- ▶ Raise the profile of Engineering, manufacturing and construction; the careers and opportunities
- ▶ Provide opportunities to address gender and diversity imbalances in engineering and manufacturing
- ▶ Increase teacher confidence in delivering STEM through an engineering project
- ▶ Inspire pupils to engage with Science, Technology, Mathematics, Literacy and enhance wider social skills through engineering
- ▶ Link schools with engineers to increase awareness (pupils and teachers) of engineering, manufacturing and construction
- ▶ Provide opportunities for parents to be aware of the engagement

### Primary Engineer deliver:

- ▶ Management of the schools engagement
- ▶ Event management of training and celebration events
- ▶ Teacher CPD, for two teachers per school – from Key Stage 1 and Key Stage 2
- ▶ Teaching resources via Primary Engineer Virtual Learning Environment
- ▶ Opportunities for engineers to attend the teacher training days and link to schools
- ▶ Package, and deliver at the events, starter sets of tools and consumables
- ▶ Collation of feedback evaluations from teachers, engineers and, at events, pupils.



# Programme Timeline – Year 1

Primary Engineer is an official partner organization for the UK Government Year of Engineering. The timeline for the Primary Engineer & Secondary Engineer Programmes would commence in 2018 to provide the funding partner with an opportunity to promote the programmes as part of their Year of Engineering activity and legacy.

2018	
	
February onwards	Opportunity for press/PR campaign as part of Year of Engineering and legacy
February to September	<p>Primary schools identified by Primary Engineer team in conjunction with funding partners and registered for the programme.</p> <p>Engineers identified and linked with schools by Primary Engineer team</p>
October	Primary Engineer Structures and Mechanisms with Basic Electrics teacher CPD training day hosted at Hethel Engineering Centre
October – June 2019	<p>Teachers delivering Primary Engineer Structures and Mechanisms with Basic Electrics Programme in schools.</p> <p>Engineers supporting programmes in schools</p>
July 2019	<p>Celebration Event &amp; Competition for participating schools hosted at Hethel Engineering Centre</p> <ul style="list-style-type: none"> <li>- Participating schools bring teams to compete</li> <li>- Engineers to judge (along with other funders)</li> <li>- Funding partner representative(s) to present awards</li> </ul>

# Celebration Event & Competition

The Primary Engineer & Secondary Engineer Programmes will bring teachers and pupils together at the end of the academic year in July for a Celebration Event and Competition hosted by Hethel Engineering Centre (date TBC). The Celebration Event and Competition is organised and managed by the Primary Engineer Events Team and is a morning event.

Participating schools will bring teams with their vehicles and supporting work and will test their designs and compete against each other against set scoring criteria. Pupils will also meet engineers who will be the judging team on the day. Engineer judges discuss with pupils their designs, the processes they have been through, decisions they have made, problems they have faced and how they overcame them during the programme.

All participating teams will be presented with a certificate for representing their school at the Celebration Event and Competition. Winning teams will be selected based on performance against the success criteria. Awards will be also made to the teams considered to have the 'Best Themed' vehicle and to be the 'Best Communicators'.

The Celebration Event and Competition is an excellent opportunity for funders to present the awards to pupils and to give a short motivational speech. It also provides a fantastic press, PR and comms opportunity.



# Funding Level

1. To join existing funders (BFPA, Hethel Engineering Centre, Pangean Engineering, Proeon Systems, Ardagh Group) to fund additional schools to provide the Primary Engineer Programme: Structures and Mechanisms with Basic Electrics.

Included:

- ▶ Teacher CPD, for up to two teachers per school – from Key Stage 1 and Key Stage 2
- ▶ Teaching resources via Primary Engineer Virtual Learning Environment
- ▶ Opportunity for engineers to attend the teacher training days and link to local schools
- ▶ Celebration Event & Competition where teams are invited to compete
- ▶ Opportunity for engineers to be judges at the celebration event
- ▶ Starter sets of tools and consumables for schools
- ▶ Process managed by Primary Engineer team

Funding Level: £650 per school (including VAT where applicable)



## Partner Organisations and Funders

### Council and Government organisation funders



### Tier One Corporate Funders



### Strategic Partners



## Primary Engineer Advisory Board

**Prof David Nash**, Vice Dean Strathclyde University; **Prof Fred Maillardet**, IMechE and formerly University of Brighton; **Mark Crabtree OBE**, Owner AMS NEVE; **Prof John Perkins CBE**, Former Chief Scientific Adviser, Department for BIS; **Graham Short MBE**, former Director of Services East Ayrshire Council; **Carol Anne Knight**, HR Director Babcock International; **Allan Cook CBE** Chairman SEMTA, Vice President RAEng, previously Chairman ATKINS ; **Elizabeth Horne**, Assistant Head Teacher St Mary’s Catholic Academy Blackpool.