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Achieving the twenty-twenty vision for embedding STEM in schools 5-19

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We are in a golden era of UK technological achievements, many of which have been quite a long time in the making. In September 2016, the European Space Agency's `*Rosetta Mission*' came to end when the Rosetta space vehicle was deliberately crashed into Comet 67P which it had been tracking for 12 years. It was launched in March 2004, but its design, and that of the experiments carried by its Philae lander probe, began much earlier. Also in 2016 Airbus Space began the first phase of its ExoMars Trace Gas Orbiter project. The second part, scheduled for 2020, will put a 300 kg rover on the planet to search for signs of past or present life. Back in 2007, Richard Noble and Andy Green met with the Science Minister, Paul Drayson, to discuss Government backing for a project to build the Bloodhound Super Sonic Car to break the world land-speed record at over 1000 mph. In his speech launching the project in 2008, Drayson said: "*Above all, my ambition is for the Bloodhound project to be a catalyst for the next generation of British engineers. It really is critical that we inspire young girls and boys to think about engineering as a career. We need engineers in aerospace, in power generation, in defence. We need them to design and build the infrastructure for a low-carbon planet*." So by 2020 we hope that not only will Bloodhound have achieved its 1000mph target, but also that the UK will be well on the road to re-establishing its position as world leader in technological education. But how?

Aulden Dunipace, MD of the Learning Partnership, established the `Race For The Line' model rocket car competition for schools in 2015. This was extended to primary schools in 2016, and is supported by Bloodhound Education, the Army, the RAF, Microsoft UK and the Micro:bit Education Foundation. The 2017 National Finals take place on 29th June. The plans for the third season of Race For The Line, starting in September 2017, have been recently announced – and are really poised to propel STEM education to a new level. *"The competition will be run as a whole year 7 STEM programme, providing up to 75 model rocket car kits so all year 7 students can take part. The teaching resources to support the STEM faculty for year 7 to deliver the year 7 STEM curriculum around the competition have been commissioned and will be supplied to all participating schools. click here. In Season 3 our goal is to support 200,000 year 7 students taking part, however schools with year 7 students can only sign up if they agree to run the competition for all year 7 students. The competition sponsors goal is to see the overall number of students inspired by STEM increase and so support will be focused on schools that agree to engage strategically with the programme as a cross curricular STEM experience for all year 7 students. It will be the most awesome start to their STEM learning journey in your school and to learn more contact 01869346609."* This is just the start of the voyage – with more competitions and resources to be launched for Y8 in 2018/19 and for Y9 in 2019/20, as well as complementary activities for primary school at Key Stage 2.

So this provides an excellent opportunity for secondary schools to be planning now to put the iSTEM+ approach into action through a phased introduction of cross-curricular projects over three years in Key Stage 3. The free curriculum materials being developed by the Learning Partnership provide an

excellent resource for departments to begin planning cross-curricular collaboration. So here is one model which has already been used successfully by some schools, and which others are now planning to use for 2017/20.

The basic idea is to develop up to 6 different cross-curricular themes each running over a half-a-term which, between them, span inspiring applications of STEM subjects in a range of areas such as engineering, life-sciences, environment, energy, well-being and digital. These need not be restricted solely to science, DT, computing and maths, but might include other areas such as geography, art & design or sports. The principle is that one department takes responsibility for coordinating a 4-6 week project around a theme chosen by staff (and maybe students too) across the whole of Year 7. Students work in small groups of 3-6, and develop their own portfolios. Other departments may contribute to this by devoting some lessons to material relevant to the theme. Thus, for example, `Race For The Line' might be adopted by the DT department who would organise some practical workshop time for students to make and test their model cars, while other departments, such as science, computing and maths, could use the free curriculum materials as the basis of supporting lessons. Another half-term the Sports area might organise practical activities from which data could be captured from video clips (e.g. with Tracker) and sensors (e.g. with micro:bits) for use in maths and science – an example is here. So within 2017/18 every Year 7 student could have participated in up to 6 varied cross-curricular STEM activities.

In 2018/19 the same cycle of projects could be repeated for the new Year 7 intake. The Learning Partnership competition, run on similar line to Race For The Line, will be for Year 8 and focus on autonomous hybrid flying machines (drones) sponsored by Airlander. This would contribute one of another cycle of up to 6 cross-curricular activities for same Year 8 classes as took part in the Year 7 ones the previous year. In 2019/20 there would then be a bank of 6 Year 7 and 6 Year 8 projects for the next student cycles. The Learning Partnership competition will be for Year 9 classes and focus on robotic handling of hazardous materials, sponsored the Culham Centre for Fusion Energy. Again this would contribute one of another cycle of Year 9 half-termly cross-curricular activities. So by 2020 any participating school would have built up a bank of 18 half-termly projects. In parallel the Learning Partnership is developing cycles of other cross-curricular challenges for Key Stage 2 STEM. So there will plenty of scope for cross-phase collaborations – ideal for multi-academy trusts spanning both KS2 and KS3.

This 20-20 vision for integrated STEM was propounded by the Cambridge Centre for Innovation in Technological Education CCITE. Ideally other interested parties will follow the Learning Partnership's leads and develop integrated cross-curricular activities and resources for both Key Stage 2 and Key Stage 3. With some careful coordination it should be possible to align such a vision with the available expert support for schools from STEM Ambassadors, the IET regional organisations, the Careers and Enterprise Company's Coordinators and Advisers, Tomorrow's Engineers etc. There is also plenty of scope for older students to help their schools using their own time, enthusiasm and digital skills to develop supporting resources and activities – following the Student Digital Ambassador SDA model. There is also an excellent opportunity to develop an accreditation scheme recognising the achievement of the students and those working with them.