



Report

**Bloodhound Education
Programme**

Follow-up Audit of Activities

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Executive summary

This executive summary presents the key findings from a Follow-up Audit of Activities of the Bloodhound Education Programme (BEP), which was undertaken by the National Foundation for Educational Research (NFER) in January 2012. The first Audit of Activities was completed in November 2009.

1. Background and Introduction

1.1 The Bloodhound Engineering Project

The aim of the Bloodhound Engineering Project is to design and build a Super Sonic Car (SSC) that will break the world land speed record, which is currently set at 763 mph. The current record is held by the ThrustSSC team, who set the record in Nevada, USA, in October 1997. The same team are involved in the Bloodhound Engineering Project. The car is now in its build phase and in 2013 it will be shipped to South Africa, aiming for a new world record of 1,000 mph/Mach 1.4.

1.2 The Bloodhound Education Programme

Linked to the Bloodhound Engineering Project is the Bloodhound Education Programme (called the 'Bloodhound Education Adventure') which targets young people aged 5-19 years. The Bloodhound Education Programme (BEP) was launched in October 2008 with the aim of inspiring the next generation of young people to pursue careers in science, technology, engineering and mathematics (STEM). Those responsible for the project believe that, by showcasing how these disciplines can be harnessed to achieve something amazing, young people will be enthused and inspired to consider careers in STEM.

1.3 The Audit

The Follow-up Audit included consultations, primarily by telephone, with the following consultees:

- six BEP staff
- sixteen partner organisations working with the BEP
- eight Bloodhound Ambassadors (both independent Ambassadors and those who work within organisations which have made a corporate commitment to the Ambassador programme)
- five businesses which are supporting or sponsoring Bloodhound
- representatives from fourteen schools/colleges which have been involved in the education programme.

It also drew on relevant monitoring and internal evaluation data related to, for example, registrations on the website, usage of resources housed on the website and attendance at events. In addition, the audit team attended an event at a primary school in South Yorkshire at which they consulted with around twenty young people and two teachers.

2. Progress since the last audit

2.1 Bloodhound Ambassadors

The number of Bloodhound Ambassadors has grown substantially since 2009, with a total of 473 Bloodhound Ambassadors now supporting the small central team. Of these, 310 Ambassadors are from businesses which have made a corporate commitment to the programme and 163 are self-motivated individuals. To date, six businesses (Intel, Arco, Institute of Mechanical Engineers, Promethean, Serco and GE (Energy)) have made a corporate commitment to Bloodhound with discussions currently being held with a seventh (Cisco).

2.2 School visits, FE roadshows and events

The Bloodhound Education Programme team and Ambassadors continue to attend key national events such as the Big Bang Fair and to run activities in primary and secondary schools across the country. Since the programme's inception, the team have visited a total of 405 primary and secondary schools to present on the work of Bloodhound and facilitate a range of practical activities. In addition, they have attended 210 national, regional and local educational events and an additional 70 events that do not have education as their primary focus such as Goodwood Festival of Speed, Fairford Air Show and Formula 1 Grand Prix.

A new edition to the team's portfolio of activities is the FE 'offer' which has now become a key element of the education programme. The FE roadshows run over several days and typically include: a two day event for college students; two days of activities with feeder primary and secondary schools; a business breakfast and a community presentation. To date, 22 roadshows have been run with 15 planned for 2012.

A total of 3,097 educational institutions have registered with Bloodhound as a result of their involvement in events and visits.

2.3 Bloodhound website and resources

In addition to the 3,097 educational institutions that have registered with Bloodhound as a result of events and visits, a further 1,780 institutions (and 3,666 individuals within these institutions) have registered directly through Bloodhound's website. A range of Bloodhound resources are available on the website and this includes: 23 topics for use in lessons in schools and colleges; 10 Cisco Bloodhound TV episodes for schools; 19 project ideas for older pupils in schools and students in colleges and universities; and a series of interactive whiteboard resources for primary schools developed by Primary Engineer. An additional 11 resources are available on the website of Bloodhound's partner, Promethean.

The team are also in the process of developing additional resources for all levels. However, there is a particular focus on the higher levels where there is a perceived gap. Some of the new materials will take the form of accredited CREST Awards. Materials being developed for colleges are being funded by LSIS. In addition, the University of the West of England and the University of Southampton are coordinating developments in resources targeted at higher

education institutions. The University of Southampton will also host a new web platform with more functionality allowing teachers to upload resources for others to access.

2.4 Bloodhound Education Centres

The education team have further developed their work in relation to Education Centres and five of these, in conjunction with partners, have recently started operating, are soon to open or are in development. The main Bloodhound Education Centre, managed by Bloodhound, is based in Bristol. Three other Education Centres in Bridgend, Manchester and Kent are also being supported by Bloodhound. Two of these are managed by schools and one by the Engineering Education Scheme, Wales. There are also early plans for an additional centre to be opened in Cornwall.

2.5 Informal education

Bloodhound is also moving into the informal education field. This includes the production of 10 Bloodhound Cisco TV episodes and a Bloodhound feature in the Beano comic in December 2011 in addition to the setting up of a world rocket car challenge with the Guinness Book of Records and a science communication competition.

2.6 Work with partners

Much of the Bloodhound Education Programme team's work is being undertaken in conjunction with partners. This includes working with private sector partners which have supported Bloodhound with time, resources and materials and/or have committed to the Bloodhound Ambassador programme, as well as working with partners in the education field with complementary aims to the BEP. Many of the private sector organisations supporting the education programme are also involved with the Bloodhound Engineering Project.

Key private sector partners which have provided resources to the BEP include Intel, Promethean, Bits From Bytes and Arco. The BEP team are also now talking to Microsoft about developing a Bloodhound game for the Xbox 360 in addition to collaborating through Microsoft's Partners in Learning Schools Programme.

Intel, Promethean, I Mech E, Serco, GE Energy, Arco and Cisco have also committed to the Ambassador programme. In addition, Cisco are supporting the BEP team's informal education work and Protocol National provide brokerage into the FE sector. Product sponsor Cosworth are also becoming more involved in supporting the BEP's educational activities targeted at the 16-19 year old age range. This includes supporting the Northamptonshire county event that is taking place in February 2012.

In addition, the BEP team link with a wide range of other partners in the educational field who have a similar remit to engage and enthuse young people in relation to STEM. This includes: STEMNET, Engineering Explained, F1 in Schools, Engineering Development Trust and Women in Science Engineering and Technology; Silverstone Study Centre; LSIS, Primary Engineer; STEPS at Work; Smallpeice Trust; Careers Box and Future Morph.

3. What is working well?

In the last two years, the small Bloodhound team have undertaken a significant amount of work with very limited capacity and funds. Key areas of success are detailed below.

3.1 Creativity and flexibility

The Bloodhound education team are creative and flexible in the way that they operate.

They are keen, and quick, to capitalise on new opportunities and partnerships and a number of productive partnerships, both with the private sector and publicly funded organisations, have been developed. In addition, the team's work is continually evolving as new opportunities and needs arise and it now includes the FE offer which, after early successes, has become a key element of its work. The FE offer is also now expanding to include county-wide events which engage large numbers of young people from schools and colleges.

3.2 Engagement of young people, schools and colleges

The BEP team have reached out to a large number of young people, schools and colleges.

The high profile that the team has achieved and the scale of their work in engaging young people is impressive and has been noted by a number of partners. One of the key strengths of the BEP education team members, Bloodhound Ambassadors, and members of the engineering team who attend and speak at events, is their ability to engage young people about the car, engineering and STEM subjects more generally. The presentations the team give are inspiring and teachers appreciate having speakers in school who are actually working on the development of the car. In addition, young people (and their teachers) value the opportunity to undertake hands-on practical activities, such as making and racing balloon powered cars, which encourage pupils to be creative and independent.

3.3 Engagement of girls and young women

The Bloodhound education team have put significant effort into tackling gender stereotypes and engaging girls and young women in the project, and with engineering more generally, and this element of their activities is also working well. The team provide female role models at events and visits who generate many questions about their jobs and what they do. Having female role models within the Bloodhound engineering and education team has meant that girls can see that opportunities within engineering are equally open to girls as well as boys.

3.4 Resources

A large proportion of the teachers consulted had used the Bloodhound resources in their teaching.

Some of them had only used the video clips and presentation but a small number had used the full range of the resources and had integrated Bloodhound into the curriculum over the course of a term or even, in one case, over the entire academic year as described in the box below.

3.5 Engagement with, and work of, Ambassadors

The Bloodhound education team have successfully engaged the commitment of a large network of Bloodhound Ambassadors. Some are supported by their employer to engage whilst others are giving up their free time to represent Bloodhound. Many of these independent Ambassadors undertake their Bloodhound work in addition to a full-time job, with a large number spending at least a day a month on their Bloodhound activities. They give their time freely as they are inspired by the project and what it is attempting to achieve. **The enthusiasm and commitment of those Bloodhound Ambassadors consulted as part of the audit is impressive** and all of them thoroughly enjoy their work for Bloodhound. Independent Ambassadors who have been supported by team members in the early stages of their work with Bloodhound have found this to be very beneficial. They have been able to 'shadow' the team members and get tips on presentation skills and how to engage the children.

A number of Ambassadors working within businesses that have made a corporate commitment to the Bloodhound Education Programme have commented on the effectiveness of having a network, or social community, of Ambassadors who support each other. One business has established a buddy system so that the Ambassadors always feel supported.

3.6 Engagement with partners

The education team have secured a significant amount of good will and have developed some very effective relationships with partners. This includes partnerships with private sector businesses and organisations with a remit to increase young people's engagement in STEM. However, some of their earlier partnerships now need revitalizing.

4. Outcomes

The Bloodhound Education Programme has resulted in a range of important outcomes for young people, teachers, Ambassadors and businesses as highlighted below.

4.1 Outcomes for young people

The programme has **increased young people's understanding of engineering and the importance of STEM subjects.** This includes a broader understanding of the different types of engineering and what engineers do. The Bloodhound education team's work makes engineering accessible and relevant to young people's lives and gives a real example of an engineering project in the UK. In addition, the team and their network of Bloodhound Ambassadors have succeeded in exciting and enthusing young people about engineering and have encouraged them to become involved.

The activities that the team deliver **help young people to develop and practise a range of new skills** including teamwork, following instructions and working on a task, problem solving, and communication and presentation skills. They learn how the STEM subjects are applied in practice and are also **acquiring new knowledge.** For example, in developing and

improving their cars, they are also thinking and learning about the aerodynamics of the car, design, speed and distance.

As part of their activities, the Bloodhound education team raise young people's awareness of the jobs and careers open to them in engineering and they challenge gender stereotypes. Where possible, **team members and Ambassadors bring the careers dimension into events, school and college visits** so that both young people and their parents are aware of what is on offer to them in the future and the path they need to follow to get there. As a result of raising young people's awareness of what engineering is about, some young people are inspired to consider pursuing engineering careers in the future.

4.2 Outcomes for teachers

Although the main aim of Bloodhound's activities is to inspire young people, there are some knock-on benefits for teachers. Through engaging with the Bloodhound project, **many teachers have experienced benefits in relation to developing their own knowledge and skills in STEM subjects and revitalising their teaching**. Some teachers have embedded Bloodhound resources within the curriculum and using Bloodhound as a theme has allowed them to bring alive and demonstrate the practical application of STEM subjects. One of the schools consulted is developing a Bloodhound challenge for feeder primary schools.

4.3 Outcomes for Bloodhound Ambassadors

A range of outcomes have been realised for Bloodhound Ambassadors, with all of the Ambassadors consulted saying that they would recommend to others that they should get involved in the Bloodhound Education Programme.

The majority of Bloodhound Ambassadors have mentioned that **personal satisfaction and enjoyment of the Bloodhound work has been a key outcome of their involvement**. A number of the Ambassadors are real enthusiasts about the Bloodhound car and some were also involved in the predecessors Thrust2 (1983) and ThrustSSC (1997). Being involved as an Ambassador has helped them to get closer to the engineers who are working on the car.

All of the Ambassadors consulted have mentioned that working as an Ambassador has involved developing some new skills and knowledge. These include: presentation skills; skills in communicating and engaging with children; IT skills (needed to develop and deliver presentations); and science, maths and technology knowledge. Many Ambassadors commented that volunteering as an Ambassador has increased their confidence and, for those not currently employed, it has boosted their self esteem and developed their CV.

4.4 Outcomes for businesses

A range of outcomes have been realised for businesses as a result of their involvement in the Bloodhound Education Programme. All of the business consultees would recommend that other businesses should get involved in the programme.

For all businesses, collaborating with Bloodhound is helping them to achieve their aim to encourage young people to study STEM subjects and inspire future engineers and designers. For businesses, Bloodhound is **a 'vehicle' to raise young people's engagement in STEM and engineering and helps them to achieve their corporate social responsibility objectives.**

A number of businesses have engaged in Bloodhound to increase awareness of their business and for public relations. **Three of the businesses noted that working with Bloodhound had increased the media coverage and PR which they received and had improved public awareness and perceptions.** The publicity from working with Bloodhound is also enabling businesses to work more closely with schools than previously.

Business consultees also noted that working with Bloodhound had **increased staff satisfaction and, for some, it has also supported them to develop their business in this country and abroad.**

All of the business representatives said that they were keen to maintain strong links with Bloodhound. The success of the work so far, and increased publicity and media attention as the land speed attempt grows nearer, were particularly attractive reasons to carry on their involvement.

5. Areas for development

What the Bloodhound education team have achieved in a short amount of time and with limited capacity is impressive. However, there are some areas that they could improve and enhance, which are detailed below. The team are already focusing on many of these areas.

5.1 Consolidation and action planning

It seems that **now would be a good time for the team to consolidate their activities and develop a formal plan for the future,** focusing on what they are really good at and on areas requiring further development, such as the online resources. Given the evolving nature of Bloodhound's work and the need to respond to new opportunities as they arise, it is suggested that forward plans should cover the short-term (i.e. the next year, 2012/13), which the team are in the process of developing.

5.2 Resources

The Bloodhound education team are aware that the number and range of resources has not changed significantly since the last audit in 2009 and that this is a key area for future development. **There is a particular gap in relation to resources at the higher levels** and Bloodhound are collaborating with LSIS and with universities to fill this gap.

It would also be useful if the resources could be ordered or catalogued more effectively and more closely matched to the curriculum. This would help with accessibility and increase usage. In addition, it would be useful if additional practical

exercises could be devised to supplement those already available which work very effectively, such as the balloon powered car.

5.3 Follow-up with schools

Both teachers and Ambassadors have commented that **it would be helpful if more ongoing and sustained relationships were developed between the Bloodhound education team and schools**. This is already happening to some extent with Ambassadors and the team developing relationships with particular schools but, in some cases, schools' engagement with Bloodhound is through a one-off event and not followed up or capitalised upon. More ongoing contact would enable, and encourage, schools to embed Bloodhound into the curriculum and for it to be an ongoing theme that is returned to. This could be achieved by further visits to schools but this is time intensive and may not always be possible. The development of new resources, and the improved cataloguing of existing resources should support schools' ongoing activities on the Bloodhound theme. In addition, the 'Ambassador in a Bag' resources which will soon be available that Ambassadors can leave behind at schools should be very effective at supporting schools' continued engagement. A more sustained relationship with schools will also support the achievement of longer-term impacts on young people which can be more easily measured.

5.4 Ambassadors

Another area of development is **increasing the levels of support for all new Ambassadors and formalising a 'buddy' system**. In some cases, the buddy system is already operating, particularly within businesses that have made a commitment to the Ambassador programme. Another way of supporting independent Ambassadors would be to pay for their travel expenses which would enable them to increase their involvement.

5.5 Communication with stakeholders

All stakeholder groups have mentioned that **communication with Bloodhound education team members could be improved** (i.e. made more speedy and regular) to make working relationships more efficient and that the structure of the team and staff roles and responsibilities could be made more transparent.

5.6 Bloodhound Education Centres

The Bridgend Education Centre staff would benefit from more clarity as to its remit, including who it should target and activities that it might deliver. In addition, **a marketing plan for both the Bristol and Bridgend Education Centres is needed to ensure that they are fully utilised**. A key barrier that both of these Education Centres will face is getting young people out of school due to time and travel costs and consideration needs to go into how this barrier will be overcome. In addition, it would be useful if a forum or network of centre managers was set up to enable them to share learning and good practice.

5.7 Partnerships

The Bloodhound education team have developed a large number of partnerships since project inception and this is a key area of strength. Many of these partnerships are very

productive with both partners gaining from the collaboration. However, some partnerships, particularly those developed early on and linked to DCSF funds, are working less effectively. At this point in time, **it would be useful for the Bloodhound education team to review their partnership working and to develop a plan for partnership working from here on.** They have developed a 'memorandum of agreement' with some partners and it would be helpful if a similar type of formal plan could be developed with all key partners.

6. Concluding comments

The work of the Bloodhound Education Programme has evolved and changed over the last two years and the achievements of the small team are impressive. In particular, the team have been very effective at engaging with, and inspiring, a large number of young people in schools and colleges and tackling gender stereotypes. In addition, they have secured significant commitment from a large number of businesses, Bloodhound Ambassadors and private and publicly funded partners to their involvement in the programme.

As with any initiative, there are areas which the team could enhance and improve. At this point in time, it seems sensible for the team to review their progress to date and consolidate their activities. This should include plans to focus on what they do particularly well and areas that need further development, such as increasing the range of online resources to encourage schools' sustained involvement in Bloodhound and revitalizing earlier partnerships. In addition, the new Education Centres now require more widespread marketing and plans to overcome barriers to the release of pupils and students from schools and colleges. A more formalised buddying programme for all Ambassadors would also be beneficial for independent Ambassadors which would enable them to 'hit the ground running'.

1. Background and introduction

1.1 The Bloodhound Engineering Project

The aim of the Bloodhound Engineering Project is to design and build a Super Sonic Car (SSC) that will break the world land speed record, which is currently set at 763 mph. The current record is held by the ThrustSSC team, who set the record in Nevada, USA, in October 1997. The same team are involved in the Bloodhound Engineering Project. The car is now in its build phase and in 2013 it will be shipped to South Africa, aiming for a new world record of 1,000 mph/Mach 1.4.

1.2 The Bloodhound Education Programme

Linked to the Bloodhound Engineering Project is the Bloodhound Education Programme (called the 'Bloodhound Education Adventure') which targets young people aged 5-19 years. The Bloodhound Education Programme (BEP) was launched in October 2008 with the aim of inspiring the next generation of young people to pursue careers in science, technology, engineering and mathematics (STEM). Those responsible for the project believe that, by showcasing how these disciplines can be harnessed to achieve something amazing, young people will be enthused and inspired to consider careers in STEM.

Through the provision of information about the research, design, building and testing of the car, the education programme provides pupils in primary schools and students in secondary schools, colleges and higher education with the opportunity to engage with the Bloodhound Engineering Project. All of the information about the car is freely available to schools and colleges.

An open data engineering adventure education project such as Bloodhound has never been attempted before. The creators of exciting high performance vehicles such as Defence Space and Formula 1 are not able to provide comprehensive data due to issues such as intellectual property rights, national security and competitive positioning. The FIA world land speed record rules require only four or more wheels and driver control. This minimal prescription encourages a wide range of very different challenger vehicles and thus technology is unlikely to transfer to competitors. It, therefore, becomes possible to make all of the Bloodhound technology available with minimal risk.

Due to the lack of a project precedent using open technology as an education stimulant on this scale, the Bloodhound education team has to be innovative, creative and responsive in developing its activities and exemplifying best practice. It is hoped that other British industries will benefit from the learning that Bloodhound provides

and that this will be extrapolated in partnership with the new British Open Data Institute.

The BEP consists of a variety of components aimed at the different school levels and the community more broadly. One key component of the programme is the provision of free **resources** which can be accessed on the BEP website: <http://www.bloodhoundssc.com/education.cfm>. Schools and colleges can gain access to a variety of experiments and exercises. University-level engineering and technology students can access real design challenges and test data as the Bloodhound Engineering Project develops. The higher education strand is being led by a group of academics from the University of the West of England (UWE) and the University of Southampton.

In addition, the Bloodhound education team organise and run a range of Bloodhound **events** for educational institutions as well as attend and run sessions at externally organised events, roadshows and schools. Bloodhound Ambassadors are key to the success of this work. An increasingly important feature of Bloodhound's education work is the '**FE offer**' which includes three day events run within colleges at which the BEP team engage with college students as well as pupils from local primary and secondary schools, businesses and the local community.

The Bloodhound education team are also setting up a number of Bloodhound **Education Centres** which will allow the team to work more intensively with pupils and students out of the school environment.

The team are starting to take first steps into the '**informal**' **education sector** with Bloodhound Cisco TV programmes and they have plans in place with a variety of partners to further develop global reach.

In addition, the BEP team has engaged with a range of private and public funded **partners** who are supporting Bloodhound's educational activities.

1.3 Aims and methodology of the follow-up audit of activities

The National Foundation for Educational Research completed an Audit of Activities for the BEP at the end of 2009. It was then commissioned in January 2012 to undertake a Follow-up Audit of Activities to explore how the BEP had progressed since the last round of consultations and data collection. The report from the first audit can be found at the link: www.nfer.ac.uk/bloodhound

The Follow-up Audit included consultations, primarily by telephone, with the following consultees:

- 6 BEP staff
- 16 partner organisations working with the BEP
- 8 Bloodhound Ambassadors (both independent Ambassadors and those who work within organisations which have made a corporate commitment to the Ambassador programme)
- 5 businesses which are supporting or sponsoring Bloodhound
- representatives from 14 schools/colleges which have been involved in the education programme.

It also drew on relevant monitoring and internal evaluation data related to, for example, registrations on the website, usage of resources housed on the website and attendance at events.

In addition, the audit team attended an event at a primary school in South Yorkshire at which they consulted with around twenty young people and two teachers.

2. Management, staffing and funding

2.1 Management and staffing

The BEP continues to be managed and delivered by a small team of staff supported by Bloodhound Ambassadors and a range of partners. The core team includes:

- the Education Director, responsible for policy, plans and strategy and the Ambassador Programme
- the Delivery Director, responsible for direct delivery into schools, communications and monitoring
- the Education Centre Manager, who runs the Education Centre in Bristol and supports the other centres which are being set up in addition to leading on the development of technical resources for further and higher education
- two trainers/animators, who train Bloodhound Ambassadors and support the other members of the Bloodhound education team at events.

The web manager working on the engineering project also devotes some time to supporting the BEP through updating the website and monitoring activity.

The BEP team has no physical headquarters and many of the staff work from home. However, the Education Centre located in Bristol, which is also where the car is being built, provides a focal point for the BEP team. Communication between members of the BEP team and the members of the engineering side of the organisation is aided by the production of a weekly newsletter that provides progress updates.

The team are supported by a team of Bloodhound Ambassadors who give their time freely to the programme by promoting Bloodhound at events and presenting and running practical sessions at schools and colleges.

2.2 Funding

The BEP received start-up funding of £615,000 from the Department for Children, Schools and Families (DCSF), now the Department for Education (DfE). Additional 'in kind' support, resources and equipment have been provided by a range of private sponsors, such as Intel and Promethean, as well as a range of other organisations with similar educational aims to Bloodhound. Of the funds provided from the DCSF, £100,000 was allocated to the establishment of the Bloodhound Education Centre in Bristol. In the first year of operation, some of the funding was also allocated to a number of partner organisations, to support the development and delivery of Bloodhound-themed resources and activities. These amounts were between £5,000 and £56,000 and allocations depended on the nature, scope and scale of the resources and activities being developed and delivered. Since 2010, the BEP has

existed entirely through private sector sponsorship, donation of equipment and resources and the support of its volunteer network of Bloodhound Ambassadors and 1K Club members.

The total expenditure of the education project to date (from its initial development stage in April 2007 to February 2012) is £906,614. This is a cost of approximately £19,709 a month over 46 months.

3. Progress since 2009 audit

The Bloodhound Education Programme has continued to develop its education offer since the last audit. The following section describes the range of activities that the Bloodhound education team have developed and delivered since the end of 2009.

3.1 Overview of progress since the end of 2009

The work of the BEP team has evolved and changed since the last audit. In 2009, a large emphasis of their work was on delivery through partners which was funded through the grant provided by the DCSF (as was). This funding ran out in 2010 and, although the Bloodhound education team are still in communication with these partners, the partnership working is less strong. However, the Bloodhound education team have broadened out their activities to include other partners – particularly from the private sector – and they have also developed an 'FE offer, more details of which are provided below in section 3.3.

The number of Bloodhound Ambassadors supporting the work of the small central team has grown substantially since 2009. Bloodhound have secured the corporate commitment of a number of businesses to the Bloodhound Education Programme and these businesses support and encourage a number of their staff members to undertake activities as Bloodhound Ambassadors.

The Bloodhound Education Programme team and Ambassadors continue to attend key national events such as the Big Bang Fair and to run activities in primary and secondary schools across the country. The team also encourage educational institutions to register on the Bloodhound website and to access the range of free resources available. However, progress in developing and adding to these resources has been slow and the education team recognise that this is now a key area to develop further.

The education team have also further developed their work in relation to Education Centres and there are now five of these which, in conjunction with partners, have recently started operating, are soon to open or are in development.

3.2 Bloodhound Ambassadors

There are currently a total of 473 Bloodhound Ambassadors. Of these, 310 are Ambassadors from businesses which have made a corporate commitment to the BEP and 163 are individuals – who may be employed, self employed, retired, unemployed or carers – who have made a personal commitment to the Bloodhound education programme. Of the 473 Ambassadors, 171 have attended the formal training run by the Bloodhound education team. Bloodhound Ambassadors are also STEMNET STEM Ambassadors and they are CRB checked within this programme and can access the STEMNET training that is provided.

A further 40 individuals have shown an interest in the programme and have been provided with information. They either still need to make a formal application or be CRB checked and trained. In addition, the BEP team are setting up a Cisco System Ambassador programme and it is planned that a further 53 Ambassadors will join the BEP from the Institute of Mechanical Engineers (I Mech E).

Table 3.1.1 below provides details of the businesses which have made a corporate commitment to the BEP and the number of Bloodhound Ambassadors they already have, or who are soon to be trained or to join the programme.

Table 3.1.1: Bloodhound Education Programme: Bloodhound Ambassadors

Business	Number of Bloodhound Ambassadors
Intel	39
Arco	52
I Mech E	183 (with an additional 53 planned)
Promethean	8
Serco	8 (being trained in February 2012)
GE (Energy)	20 (being trained in January/February 2012)
Total	310

Source: BEP, January 2012.

When Ambassadors first join the BEP they are invited to a full days' Bloodhound training at which they cover: an introduction to Bloodhound; health and safety; safeguarding in schools; equality and diversity; working with schools and pupils; STEM careers; and presentation skills. They also look at the materials that are available on the website for their use in schools/colleges and the types of practical activities that they might deliver, as well as receive tips for engaging and communicating with young people and presenting technical information simply with the younger age groups.

A number of resources for Bloodhound Ambassadors to use are available on the website. This includes plans and guidance for running practical activities (such as designing a balloon car, a rocket car or an air powered 'dragster'), video clips, images, quizzes and worksheets. There are also standard presentations on Bloodhound and templates which Ambassadors can use for designing their own presentation. In addition, there are a number of documents relating to risk assessments, safeguarding, consent for photographs and evaluation.

Two new Ambassador trainers have recently joined the team (one is covering the north of England and the other the south) and they are currently reviewing the training delivered to Ambassadors and the materials used, with a view to incorporating more information about the education system.

'Ambassador in a Bag' resources are also being developed which will be launched at the Big Bang Fair in March 2012. These are fun activities for Ambassadors to use

(e.g. looking at the effect of pressure and forces) which can also be left behind for teachers to use in lessons.

In addition to Bloodhound Ambassadors, a number (60) of interested members of the Bloodhound SSC supporters club, the '1K Club', have helped out at various events and science festivals, such as Manchester Science Festival and the Imagineering Science Fair in Warwickshire. Some have also joined the Ambassador programme and others give ad-hoc presentations to interested groups and societies. 1K Club membership is available at bronze and gold level. As at the end of January 2012, there was a total of 4679 1K Club members. Of these, 2529 were bronze and 2150 were gold members.

3.3 School visits, FE roadshows and events

3.3.1 School visits

Since their inception, the Bloodhound Education Programme team, in conjunction with Bloodhound Ambassadors, have visited a total of 405 primary and secondary schools to present on the work of Bloodhound and facilitate a range of practical activities such as making and building a balloon, rocket or K'Nex car. Activities at schools are customised to the school's needs and the format of the day is arranged in advance.

Some of the Bloodhound education team's work in schools (and at events – see section 3.3.3 below) targets girls in particular in order to challenge gender stereotypes¹. More than 1,500 girls have been involved in these girls-only activities. In addition, when activities are being planned in schools, the team encourage the school to have a mixed group of pupils.

3.3.2 Further education (FE) roadshows

A recent addition to the BEP's portfolio of activities is the FE 'offer' and, since the previous audit, the FE roadshows have become a key element of the BEP. The roadshows are of mutual benefit for Bloodhound and the colleges concerned. The BEP team have the opportunity to raise awareness of their project and gain access to a large number of young people and the colleges are able to raise awareness amongst young people, parents, businesses and the community as to what they provide. The roadshows are organised by the colleges.

¹ The Bloodhound education team have been involved in thirteen girls-specific school visits or events to date. This includes 4 school visits and 9 events which have attracted girls from a number of schools. The larger events include: Glazier's Hall, Women's Engineering Society Conference Event in Surrey, workshops in SE Cornwall, a WiSE event in Bristol, an after-school careers event in Gloucester, a Girls in Science Day for the Girls School Association and a Skirting Science event in Western-Super-Mare.

The roadshows are run over several days and include the following type of format:

- two day event in college
- two days of activities with local/feeder primary (Key Stage 2) and secondary schools (Key Stage 3 and 4) – this can include up to 20 secondary schools and 40 primaries
- a business breakfast with SMEs
- a community presentation.

A Bloodhound exhibition is also set up with a full-scale Bloodhound show car on display.

The two days of activities for college students usually include a presentation on Bloodhound, showing the car and how it is being made and the facilitation of a range of practical exercises. The two days of activities with local school pupils follow a similar format. Practical activities run with college students and school pupils might include: designing, building and racing a balloon powered car; firing a rocket (using ethanol in a plastic bottle); a kit car racing challenge; gravity racers; and having a go on the Bloodhound simulator.

The aim of the business breakfast is to raise local SMEs' awareness of the FE college offering and to discuss skills needs. This might, for example, include a presentation on Apprenticeships and what they can offer businesses.

Over the course of each FE roadshow the Bloodhound education team can access up to 1,000 pupils from local schools in addition to college students who are studying STEM A-levels and Advanced Apprenticeships.

In some cases, the FE offer is run in conjunction with local businesses which use the opportunity to raise awareness of their organisation and improve recruitment. For example, an FE event is currently being planned in Northamptonshire in conjunction with Cosworth which is keen to attract more applicants.

The Bloodhound education team started running FE roadshows in February 2011 and, to date, 22 events have been run with 15 planned to be completed in 2012. The event happening in Northamptonshire in February 2012 has developed beyond an FE roadshow to become a county-wide event.

3.3.3 Events²

The Bloodhound education team and Ambassadors have attended 210 educational events since the launch of the BEP in 2008. This includes attendance at large national events such as The Big Bang Fair, the British Science Festival and the BETT Show as well as regional and locally organised educational events. As mentioned in section 3.3.1 and in footnote 1, the Bloodhound education team have also been involved in a number of events specifically targeted at girls where they have used women engineers as role models.

In addition, the team have attended around 70 other events which have not necessarily had education as their main focus. This includes: Goodwood Festival of Speed, the Autosport Show, Fairford Air Show, Farnborough Air Show, Formula 1 Grand Prix, Moto Grand Prix, the MACH Show (showcasing the latest manufacturing technologies) and the Annual Convention of the Institute of Directors. However, for the BEP team, the value of STEM education is always the underpinning theme to their work whether the event they attend has an education focus or not.

During 2011, the project's articulated transporter carried the Bloodhound show car and exhibits a total of 34,000 miles.

See footnote 2 for an example of the types of educational focused events that the BEP team have attended.

3.3.4 Engagement through events and visits

In addition to the 1,780 schools that have registered with the Bloodhound Education Programme on the website (see section 3.4 below), a further 3,097 educational institutions have registered as a result of their involvement in events and visits in which the Bloodhound education team have had a presence. This means that a total of 4,877 institutions have registered with the education programme through either the website or events. Of these institutions:

- 3 are nursery schools (1%)
- 2,510 are primary schools (51%)
- 2,047 are secondary schools (42%)
- 270 are FE colleges (6%)

² Examples of educational focused events attended include: Association of Colleges Event, BETT Show, Big Bang Fair (national and regional), British Science Festival, Cheltenham Science Festival, Design & Technology Show, Enfield Education Business Partnership event, F1 in Schools Challenge, Gaydon event, Greenpower Challenge, Imagineering Science Fair in Warwickshire, Institute of Physics event, K'Nex Young Engineers Challenge, Manchester Science Festival, Manufacturing Forum event, Museum of Science and Industry event, Navy days, Nissan event, Oxford Science Festival, Primary Engineer events, Richmond Science Festival, Rockingham Festival, Southampton Science Festival, Specialist Schools and Academies Trust (SSAT) event, SSAT event targeting technology teachers, UK Space Conference, University of the West of England events.

- 47 are universities (1%).

As can be seen, primary schools make up more than half of all registrations which is where Bloodhound is particularly focusing its efforts.

Registrations at events come from institutions located in all regions of the UK as well as the Channel Islands.

The vast majority of schools registered have a mixed intake with a small, and similar number, of boys and girls-only schools.

Ninety-one per cent of the schools registered are state schools with nine per cent being independent.

3.4 Engagement via the website

The BEP website contains a range of information and resources which schools and colleges can engage with or download. This includes:

- resources for schools and suggestions of topics to use in lessons, suggested projects for students, and the Primary Engineer resources
- Cisco Bloodhound TV
- facts about the car
- video interviews with the design team
- an online form to request a Bloodhound Ambassador
- a news section
- information on the engineering initiatives offered by partner organisations (e.g. F1 in Schools and Greenpower) and careers websites.

See section 3.5 for further information on the resources available on the website.

Staff and individuals from schools, colleges and other organisations with an educational remit are invited to register their interest in Bloodhound on the website after which they can access the teaching resources and receive regular email updates. To date, a total of *3,666 registrations from individuals* have been received. These individuals come from a total of *1,780 schools*.

Table 3.1.2 below provides details on the breakdown of these registrations by the educational institution in which each individual works. Staff within primary or preparatory schools make up just over a fifth of the registrations, with half of the registrations coming from staff within secondary schools and sixth form colleges. It is interesting to note that this data contrasts with that on the events and visits which tend to primarily attract and target primary schools.

Table 3.1.2: Bloodhound Education Programme: Individual registrations by type of institution

From UK Educational Institutions	As at end January 2012	
	N	%
Primary (LA)	556	
Primary Foundation	82	
Middle School	112	
Preparatory School	73	
Total: Primary/Prep	823	22%
Secondary (LA)	1232	
Secondary Foundation	178	
Secondary Independent	296	
Special School	60	
Sixth Form College	57	
Total: Secondary/Sixth Form	1823	50%
College of FE	212	
College of Higher Education	35	
University	145	
Total: FE/HE	392	11%
Local Authority	50	1%
Home educator	120	3%
Other ³	458	12%
Total	3666	100%

Source: BEP, January 2012.

Percentages may not sum to 100 due to rounding.

Table 3.1.3 below provides information on the role of those individuals registering on the website. More than a third are primary or secondary teachers with five per cent being lecturers in further or higher education. The site is also attracting senior staff,

³ Includes: Air Training Corps; scouts, cubs, beavers, guides and brownies; Academies; after school clubs; adult education providers; careers services; youth groups; pupil referral units; hospital education services; work-based learning providers and training providers; voluntary organisations and charities; engineering and science societies, organisations and institutes; science discovery centres; individuals (young people, parents, adults, trainee teachers, teacher trainers, students, STEM experts); STEMNET contract holders and STEM Ambassadors; education business partnerships; businesses and sponsors; research organisations; libraries and museums; media and TV companies; journalists and magazines; professional development providers and organisations.

with almost a fifth of registrations coming from heads of department/faculty and eight per cent coming from headteachers, deputies and principals.

Table 3.1.3: Bloodhound Education Programme: Individual registrations by role

From UK Educational Institutions	As at end January 2012	
	N	%
Primary teacher	418	11%
Primary head teacher	183	5%
Secondary teacher	991	27%
Secondary head teacher/deputy/principal	125	3%
Head of department/faculty	675	18%
Lecturer	201	5%
Advisor/advisory teacher/advanced skills teacher	133	4%
Student teacher	85	2%
ICT coordinator	73	2%
Other ⁴	782	21%
Total	3666	100%

Source: BEP, January 2012.

Percentages may not sum to 100 due to rounding.

Table 3.1.4 below presents data on the sources of these registrations. The vast majority of registrants leave this field blank but, of those who do complete this field, the largest proportion have found out about Bloodhound through attending events.

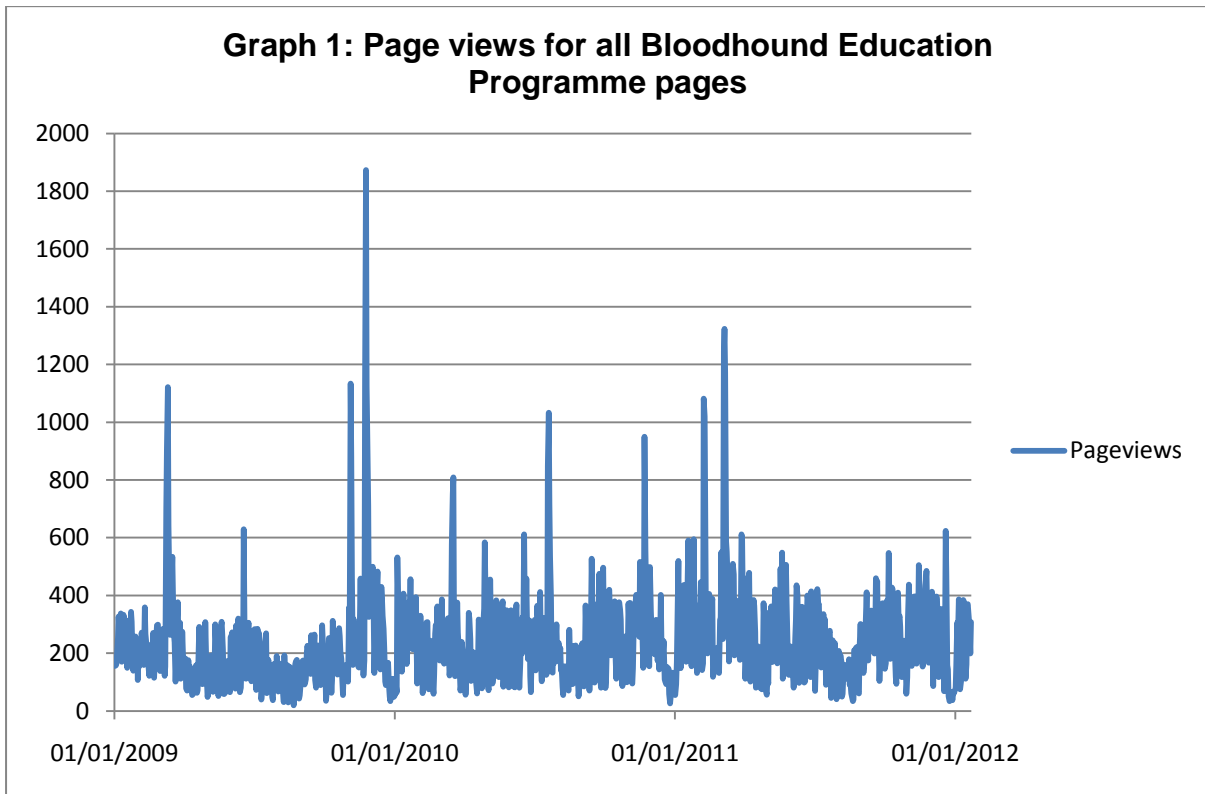
Table 3.1.4: Sources of registrations

Source	As at end January 2012	
	N	%
Bloodhound event	475	13
Website	28	1
Education event	20	<1
From a friend	15	<1
Press coverage	15	<1
Motor show	4	<1
Other event (not education focused)	2	<1
Not stated	3081	84
Total	3666	

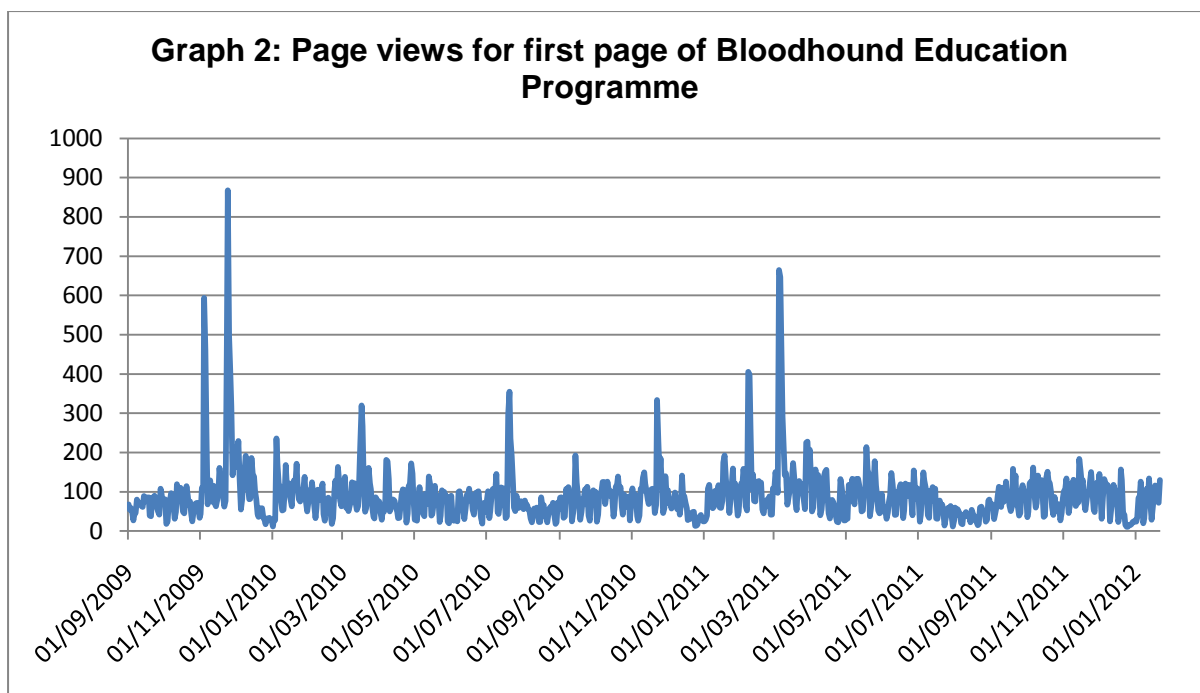
Source: BEP. Percentages may not sum to 100 due to rounding.

⁴ Includes: technicians; administrators; 1K Club members; university students; youth workers; careers advisers and mentors; writers/editors/TV producers and presenters; trainers; forces staff; governors; parents; widening participation and schools liaison staff in universities; trainee teachers; teaching assistants; STEM Ambassadors and STEM Club leaders; STEM project managers/coordinators; engineers and designers; computer scientists; researchers and data analysts; young people; staff in museums and libraries; maths and science consultants; learning support staff; home educators; guide, scout, cub, beaver and brownie leaders; and education business partnership managers.

As the graphs below show, in terms of page views on the website, there seems to have been a fairly constant interest in the Bloodhound Education Programme website pages with some peaks and troughs and an increased interest at certain times of the year, for example in the spring term leading up to National Science and Engineering Week and the Big Bang Fair in March.



Source: BEP, January 2012.



Source: BEP, January 2012.

The Bloodhound education team are also beginning to make more use of the social media such as facebook

<http://www.facebook.com/bloodhoundgang?ref=ts#!/BLOODHOUNDSSC>

and twitter

http://twitter.com/BLOODHOUND_SSC

3.5 Resources

3.5.1 Current resources

As mentioned above in section 3.4, a range of Bloodhound resources are currently available on the Bloodhound website for teachers and lecturers to use with young people and there are also more advanced project ideas for use with students at college and university. The range of resources available includes those detailed below.

- Twenty-three topics that can be used within lessons in schools and colleges (Key Stages 2 to 5). Topics include: chatterboxes; building a balloon powered car; hardness of materials; desert search; design your own Bloodhound SSC; centre of gravity; designing and building an air powered dragster; measuring the thrust profile of a rocket to predict speed; frames and structures; speed of sound experiment; designing and building a mini rocket car using Estes rockets; Bloodhound SSC systems and control; Bloodhound SSC mathematical model; measuring the trust of a balloon powered car; understanding the motion of the car's wheels; Estes Rocket launcher task; applications of CAD; and using run data. Building a balloon powered car is the most popular resource receiving 945

downloads in 2011. This is followed by: air powered dragster (586 downloads); chatterboxes (489 downloads); and model rocket car (293 downloads). Other popular resources are: speed of sound experiment (173 downloads); the motion (158 downloads); and measuring the thrust of a balloon powered car (139 downloads).

- Ten Cisco Bloodhound TV episodes for schools which have been added to the website since July 2011. These are between 3-5 minutes long and include: First Metal Cut; Schools Speed Record; Meeting the Public; Behind the scenes with the BBC (rocket firing); Why is Bloodhound the shape it is?; The performance curve; Bloodhound: The Mission; The Bloodhound Education Centre; How to learn anything in your pyjamas; and Autosport International/Design & Make. The most popular episodes to date with more than 5,000 YouTube views are: Behind the scenes with the BBC rocket firing (6,743 views); The performance curve (5,959 views); and Why is Bloodhound the shape it is? (5,250 views). Other popular episodes with more than 3,000 views are Schools Speed Record, The Mission and First Metal Cut.
- Nineteen project ideas for older pupils in schools and students at college and university which have been identified by the engineering team. Project ideas include: Runway wheels; Wheel tuning; Desert compliance; Lateral stiffness and stability of wheels; Design of the hydrogen peroxide fuel tank; Wheel stress and strain measurement; Steering force simulation; Will the parachute work?; Canopy sealing; Turn around problems; Air intake auxiliary inlets; Crashworthiness of cockpit; Refueling procedures; Paint test; Air brakes; Thermodynamic balance of the cooling system; Rocket motor force measurement; and Dynamics of the fuel tank.
- A series of interactive whiteboard resources developed by Primary Engineer for use in the primary classroom. The resources are designed to be delivered as a whole class activity, or as part of a club or engineering day. The resource includes 132 interactive pages, a pupil flipchart to create a pupil's digital portfolio, a 32 page printable pupil workbook and editable lesson plans. The resource will work on any interactive whiteboard.

Some of the BEP's resources are also located on the Intel Skool website www.skool.co.uk

A number of additional resources for schools and colleges to use in lessons are available via the website of one of Bloodhound partner's, Promethean <http://www.prometheanplanet.com>. Resources have been added to the website on a gradual basis since 2010. They are primarily targeted at pupils and students in Key Stages 2 to 5 but three of the resources can be used with those who are 18+. The resources include the following topics: How fast is it moving (1) and (2); Design a Super Sonic Car; Bloodhound SSC fact hunt; Bloodhound Science Photo Library Image ActivPack; Bloodhound SSC ActivPack1; Primary Engineer Bloodhound SSC Prototyping Activity; Just how fast does Bloodhound go?; The Bloodhound SSC Project – Engineering the Physics; Primary Engineer Chatterboxes; and The Bloodhound SSC Project. The most popular resources are: Bloodhound SSC ActivPack1 (1,362 downloads to date); Primary Engineer Chatterboxes (980 downloads); and Bloodhound Science Photo Library Image ActivPack (577 downloads).

3.5.2 Developments regarding resources

The team are currently developing more education resources, targeted at all levels of education from primary through to university, to capitalise on the information emanating from the engineering team, for example information relating to the steering wheel, gear box and rocket firings. Some of the materials will take the form of accredited CREST Awards (either science communication or design and make projects). The ultimate aim is for CREST Awards at all levels of Bronze, Silver and Gold to be awarded in different subject areas.

Some of the materials are being supported by the Learning and Skills Improvement Service (LSIS) who are funding teachers/lecturers, for example of engineering, automotive engineering and nanotechnology, to produce five packages of materials. Some of these materials will link in with CREST Awards.

In addition, the University of the West of England (UWE), in collaboration with the University of Southampton who have developed HumBox⁵, are bringing together academics from 12 universities to utilise information from the Bloodhound project – car design, test results and overall project delivery - to collectively create and disseminate materials to support the teaching of university academics in the group and across the UK. Additionally, UWE are coordinating efforts to explore how funding might be secured to support the development of Bloodhound-related teaching materials targeted at higher education students. At the recent special interest group (SIG) meeting in January 2012, fifteen representatives from the following universities participated: UWE, Southampton, Bristol, Plymouth, Lancaster, Exeter, Swansea, Westminster, Sheffield and Liverpool. Current activities for the group members are:

- the production of teaching and learning support material based on the Bloodhound project for use in higher education – this includes lecture notes, tutorial questions, project briefs and mathematical modelling exercises
- tagging and loading learning materials onto the Southampton managed system (see below) – working title ‘Knowledge Box’ – for review by SIG members
- testing Knowledge Box which will then go live from Easter 2012 for access/use by any higher education staff and students
- the production of a newsletter by the UWE team which it is intended will be circulated on a fortnightly basis to the higher education group.

The next meeting of the SIG group is planned for March 2012.

The Bloodhound education team are currently limited by the web platform that they have but they will be shortly moving to a portal hosted by the University of Southampton which will have much more functionality. In particular, it will allow teachers to upload their own resources onto the website so that they can be widely

⁵ HumBox is a new way of storing, managing and publishing teaching resources on the web such as handouts, exercises, podcasts and videos. It was initially created with funding from the Joint Information Systems Committee (JISC) <http://humbox.ac.uk/>

shared, effectively turning a static downloads page into an interactive learning community. The portal, or 'Knowledge Box', will be powerful enough to host the raw engineering data (including CAD models) coming from the engineering team and eventually the telemetry from the car itself.

3.6 Bloodhound Education Centres

The work of the Bloodhound education team has also included setting up, or supporting the setting up, of four Education Centres which use Bloodhound as a theme to engage young people with STEM.

The main Bloodhound Education Centre, managed by the Bloodhound Education Centre Manager, is based in Bristol. It was opened October 2011 within space provided by S&B Automotive Academy. Equipment has been provided by Intel, Promethean, S&B Automotive Academy and Bits From Bytes. The centre houses leading edge CAD/CAM engineering technology, Promethean interactive white boards and Intel Classmate laptops. After its official launch which attracted 16 groups of students, amongst others, the centre has started running 3 day courses funded by the University of Bath and targeted at engineering students, with the aim of encouraging them to consider going onto a foundation course or degree. The course focuses on 3D printing, which is a new manufacturing technology being used on the car. The tasks that young people are involved in include building the machines, designing the components and printing them off and they also learn about how this process is being used on the car.

The centre has also started to run activities for Key Stage 2/3 pupils, which usually include a practical activity, such as designing, making and racing balloon powered cars. The level of complexity of the activity varies depending on the age of the young people. Older pupils will collect data on speed, distance and time and produce charts and graphs when they return to school. Activities have not yet been delivered to Key Stage 4 pupils but these would be customised to the needs of the group and could include, for example, CAD and 3D printing and looking at the technology of the car.

The Bloodhound education team are also supporting three other Education Centres which use Bloodhound as a theme but which are managed by other organisations, two of which are schools. These centres accommodate similar leading edge CAD/CAM engineering technology, interactive white boards and Intel Classmate laptops to the Bristol centre. The first of these centres to open is based within Manchester Communication Academy in Harpurhey. The Academy opened the centre in May 2011 in partnership with Bloodhound, British Telecom, Intel and Promethean. The Academy will use the centre to undertake a range of STEM activities with its own students, feeder primary schools and other learning groups. Another Education Centre using Bloodhound as a theme is opening in February 2012 in Wilmington Grammar School for Boys in Kent. The school is intending to undertake STEM outreach work, again using Bloodhound as a theme, with primary and junior schools and other local secondary schools.

Another Education Centre has been opened in Bridgend in Wales and is soon to be officially launched. It is being run by the Engineering Education Scheme, Wales.

There are also early plans for another Education Centre to be opened in Cornwall. In addition, consideration is being given to opening Education Centres in Silverstone and Hull.

3.7 Informal education

The BEP is moving into the informal education field. In addition to the development of short Bloodhound Cisco TV episodes, the education team worked together with the Beano comic to include a feature on Bloodhound in December 2011.

The BEP is also linking with the Guinness Book of Records to set up a world rocket car challenge. The Joseph Leckie Community Technology College in Walsall currently holds the record for building the fastest rocket powered model car which reached a top speed of 88.89 mph. The launch for this challenge will be at the Big Bang Fair in March 2012. The finals for the competition will be held at Farnborough International Airshow where there will be a series of runs with the winning school being awarded the title (subject to their car beating the current record) World Rocket Car Champions.

In addition, the BEP team are incorporating the media into what they are doing by encouraging young people to produce science communication videos on an aspect of Bloodhound. They are setting up a competition in conjunction with Cisco which will be launched through the website and through direct communications with schools and the intention is to engage with schools and students globally. Students will be invited to make a 3 minute video on an aspect of the car that interests them. The video can be an animation or video using Bloodhound educational resources or information from the website. The winners will have their videos shown at Goodwood Festival of Speed and they will be invited to film and view the UK low speed runs in 2013 and have their video featured on Bloodhound Cisco TV.

3.8 Work with partners

Much of the Bloodhound Education Programme team's work is being undertaken in conjunction with partners. The BEP team engage with a range of partners in a variety of ways. This includes working with private sector partners which have supported Bloodhound with time, resources and materials and/or have committed to the Bloodhound Ambassador programme, as well as working with partners in the education field which have complementary aims to the BEP. Many of the private sector organisations supporting the education programme are also heavily involved with the Bloodhound Engineering Project, for example through providing equipment, resources and expertise.

Key private sector partners which have provided resources to the BEP include Intel, Promethean, Bits From Bytes and Arco. Intel have provided Classmate laptops (X10) and the Bloodhound SSC Driving Experience and have included Bloodhound resources on their Intel Skool website. Promethean have provided interactive white boards and software and have developed resources, mentioned earlier, which are available on Promethean Planet. Bits From Bytes have provided 3D printers and software. Arco provide the team with kit and safety equipment. The BEP team are also now talking to Microsoft about developing a Bloodhound game for the Xbox 360 in addition to collaborating through Microsoft's Partners in Learning Schools Programme.

As mentioned previously, Intel, Promethean, I Mech E, Serco, GE Energy, Arco and Cisco have also committed to the Ambassador programme. In addition, Cisco are supporting the BEP team's informal education work and Protocol National provide brokerage into the FE sector. Product sponsor Cosworth (provider of the CA2010 Formula 1 race engine which powers the Bloodhound rocket motor oxidiser pump) are also becoming more involved in supporting the BEP's educational activities targeted at the 16-19 year old age range. This includes supporting the Northamptonshire County event that is taking place in February 2012.

In addition, the BEP team link with a wide range of other partners in the educational field who have a similar remit to themselves which is to engage and enthuse young people in relation to STEM. More details on this work are included below.

- STEMNET: Bloodhound has a link with STEMNET in relation to their STEM Ambassadors programme. As mentioned previously, Bloodhound Ambassadors are included within STEMNET's STEM Ambassador programme. In some cases, Bloodhound also works together with STEMNET at events.
- Engineering Explained: when Bloodhound had funds from the Department for Children, Schools and Families, it was able to financially support a Bloodhound-themed workshop for pupils and students in year five to eight. The workshops are still offered to schools, and Bloodhound provides updates on the car to support them, but schools have to pay the full price for them which is £575 as opposed to £75 previously when they were heavily subsidised.
- Greenpower: Bloodhound is still in communication with Greenpower and supports events with Ambassadors but, again, they are unable to provide funds for specific Bloodhound activities (such as sponsoring a prize for the fastest lap at Greenpower events targeted at secondary students as they did previously).
- F1 in Schools: Bloodhound are still heavily involved with F1 in Schools which continues to run the specialist Bloodhound SSC category as part of its competitions. The Bloodhound SSC category focuses on aerodynamics and use of CAD and how to get from concept to the finished product. Bloodhound also supports F1 in Schools events through team members or Bloodhound

Ambassadors. Following the introduction of the Bloodhound class in the UK, the class is now being developed in UAE, South Africa, Singapore and Malaysia.

- Engineering Development Trust (EDT) and Women in Science Engineering and Technology (WiSET): the Bloodhound education team have been working with the EDT and WiSET to develop a Bloodhound First Edition Programme. First Edition is designed to widen participation by encouraging students from diverse groups to consider courses and careers in science, technology, engineering and mathematics (STEM). First Edition includes hands-on curriculum enrichment days focused on stimulating interest in young people towards STEM, both as subjects in their own right and as potential career pathways. These days are targeted at 11-16 year olds from under-represented groups. The Bloodhound education team's work in relation to First Edition has focused on running activities specifically targeted at girls (see section 3.3.1). Two of Bloodhound's partners - the University of the West of England and Swansea University - also run Headstart courses which use Bloodhound as a theme. These are residential courses targeted at year 12 students (or the Scottish equivalent, S5). Through tasks, demonstrations, visits and hands-on team projects, the courses introduce students to Bloodhound and engineering degrees and careers as well as giving them a taste of university life.
- Silverstone Study Centre and Cosworth: The Bloodhound education team have a link with the Silverstone Study Centre and, in conjunction with Cosworth, they have undertaken Bloodhound-related practical activities with pupils from schools in the Towcester area. Staff from the Silverstone Study Centre have also drawn on Bloodhound materials in their outreach work with schools.
- LSIS: as mentioned previously, LSIS have provided funding for teachers/lecturers to develop a suite of Bloodhound-related material for use in further education courses.
- Primary Engineer: the Bloodhound resources developed by Primary Engineer continue to be available for schools to purchase. In addition, the Bloodhound SSC Special Leaders Award for STEM is offered at primary, secondary and advanced levels as part of Primary Engineer's broader programme of Leader Awards for STEM. However, Bloodhound does not now provide financial support for the award.
- Young Engineers: due to lack of funding, the Bloodhound-themed K'Nex Challenge is no longer running.
- STEPS at Work: The National Education Business Partnerships Network (NEBPN) will be offering teacher placements (PDP) at Bloodhound SSC supplier companies across the UK and at the Bloodhound Education Centres.
- Smallpeice Trust: The Bloodhound education team will be providing STEM enrichment days for 12-14 year old students to enhance their creative thinking

and problem solving skills. Many of these workshops will take place at Bloodhound Education Centres.

- Careers Box and Future Morph: The Bloodhound education team are discussing how they can support the work of Careers Box and Future Morph in showcasing Bloodhound staff in their working environment.

4. What is working well?

In the last two years, the small Bloodhound education team have achieved a significant amount of work with very limited capacity and funds. Key areas of success for the education programme are detailed below.

4.1 Creativity and flexibility

The Bloodhound education team are creative and flexible in the way that they operate. They are keen, and quick, to capitalise on new opportunities and partnerships and a number of productive partnerships, both with the private sector and publicly funded organisations, have been developed. In addition, the team's work is continually evolving as new opportunities and needs arise and it now includes the FE offer which, after early successes, has become a key element of its work. The FE offer is also now expanding to include county-wide events which engage large numbers of young people from schools and colleges. As one partner commented:

They have been very good, very proactive. They are always ferreting around for new educational opportunities and new ideas for how they can encourage engineering in education (Partner 16).

Teachers and schools value the education team's flexibility and the efforts that they make to attend events and to respond to schools' requests. As one teacher commented:

They literally bent over backwards [to visit the school]. The Bloodhound Education Project team member pulled out all the stops (Teacher 11).

4.2 Engagement of young people, schools and colleges

With a small team and limited resources, **the BEP team have reached out to a large number of young people, schools and colleges.** The high profile that the team has achieved and the scale of their work in engaging young people is impressive and has been noted by a number of partners:

It's amazing with limited resources that they manage to get around to so many different events and shows...Their exhibits are very successful. They attract a lot of people and are very interactive and engaging. They do this very well... There is so much coverage and interest at schools (Partner 4)

They have got a high profile with schools particularly where D&T is a strong subject within the school (Partner 2)

They do a brilliant job of getting the word out. Teachers are aware of it and want to take part (Partner 5)

They are very active at reaching out. Their outreach programme is very good (Partner 13)

I believe that the events go down fantastically (Partner 16).

One of the key strengths of the BEP education team members, Bloodhound Ambassadors, and members of the engineering team who attend and speak at events, is their ability to engage young people about the car, engineering and STEM subjects more generally. As several partners, business consultees and teachers noted:

At their events stand they do an amazing job. There are always hundreds of kids and they are always excited by it. It's very unique and different and something they have never seen before. It's something unique for this generation to see (Partner 4)

They are very popular at exhibitions. Their stand naturally draws young people and encourages them to ask questions. It's very visual and it's easy to go up and find things out (Partner 10)

Fantastic! We get nothing but praise and great feedback after the events (Business consultee 1)

I'm impressed with what I see (Business consultee 5)

He was wonderful, his enthusiasm with the pupils. They were all totally engaged – I didn't see one pupil who was bored (Teacher at event)

It creates a real buzz (Teacher 4).

The presentations they give are inspiring and teachers appreciate having speakers in school who are actually working on the development of the car:

His [The Bloodhound Engineering Project team member's] talk was brilliant for the youngsters and he got them all asking questions... I was exceedingly pleased with everything and how it went and the feedback we got from people was excellent (Teacher 3)

It was exciting for the schools to have in the top people from the project such as Richard Noble and Andy Green as they were treated as 'celebrities' (Teacher 9).

Ambassadors, too, are inspired by hearing from the key individuals who initiated the whole project:

His [Bloodhound Engineering Project team member] enthusiasm and commitment is astonishing. He is an inspiration (Ambassador 5).

In addition, young people (and their teachers) really appreciate the opportunity to undertake hands-on practical activities which encourage pupils to be creative and independent:

Bloodhound was very, very practically based and a very exciting piece of engineering... very attractive and engaging...The wow factor was incredible...That should be everyday being delivered in classrooms shouldn't it? That kind of level of buzz of excitement and creativity will inspire children to want to go on to learn more (Teacher 2).

The balloon car activity is particularly popular with children and teachers:

They [the Bloodhound education team] got children excited and 'fired up' and even those children that were slow at the start to engage would come round to the practical activities and make a car. The children loved it [the balloon car exercise], it was very straightforward and self-explanatory so everyone can succeed with it...They won't ever forget that [Bloodhound event] (Teacher 14)

Primary school children think that it [the balloon car activity] is fantastic! (Ambassador 2)

The primary children, they are so enthusiastic. They are like coiled springs (Ambassador 3).

Within the Bloodhound Education Centres young people are able to work with industry standard equipment and resources that they are unlikely to have in school. As two partners commented:

The advanced manufacturing for Key Stage 4 at the [Bristol] Education Centre was very well received by schools. They had all the facilities they needed and kit they wouldn't get in school. It filled a niche that schools wouldn't be able to fulfil (Partner 5)

Bloodhound is helping to get the knowledge of the technology out there. It's helping kids because it is giving them a tool where they can turn design into reality cost effectively...It helps them with an engineering perspective and they can get the kids engaged more effectively as they are using the printers (Partner 16).

Most of the teachers consulted had not had to pay for the materials for practical activities delivered in schools (such as making balloon cars) as businesses were covering the cost when their Ambassadors visited schools. Others felt that the cost for materials was reasonable – one teacher had paid £200 for the materials for a rocket day.

4.3 Engagement of girls and young women

The Bloodhound education team have put significant effort into tackling gender stereotypes and engaging girls and young women in the project, and with engineering more generally, and this element of their activities is also working well. The team provide female role models at events and visits who generate many questions about their jobs and what they do.

One example of the education team's work in this area is a two day visit that the Bloodhound education team made to West Nottinghamshire College. The visit included a talk and question and answer session by one of the female education team members regarding her work on the project, the aim of which was to inspire young women to engage with science and engineering. Having female role models within the Bloodhound engineering and education team has meant that girls can see that opportunities within engineering are equally open to girls as well as boys. Another example is a 'Skirting Science' event which brought together year 9 girls from 15 schools to inspire them about STEM. The Bloodhound education team facilitated a practical activity on building a balloon powered car which the girls 'absolutely loved' (Partner 5). As two partners and a teacher commented:

Girls didn't have these types of aspirations before...They are breaking down gender stereotypes (Teacher 14)

Skirty Science was really good. The girls loved the workshops and the air powered cars. Our original reservations regarding the girls were unfounded. It engaged the girls very effectively (Partner 5)

She [Bloodhound education team member] does a great job. It's very good the way she presents it. She is a very good role model to promote the project (Partner 7).

One teacher commented that Bloodhound helps promote women in engineering as more women are involved in this project than any other engineering project outside Russia where there is forty per cent engagement by women. This fact impressed this teacher and encouraged their participation in the project.

A large proportion of the teachers consulted commented that often the girls were better at the tasks than the boys. This was due to a number of reasons including that girls were more skilled at teamwork, that they read the instructions instead of 'powering on through' and that they took their time and improved on what they were doing. As one teacher commented: 'Success levels were better with girls as their teamwork skills were much better' (Teacher 6).

4.4 Resources

A large proportion of the teachers consulted had used the Bloodhound resources in their teaching. Some of them had only used the video clips and presentation but a small number had used the full range of the resources and had integrated Bloodhound into the curriculum over the course of a term or even, in one case, over the entire academic year as described in the box below.

Embedding of Bloodhound resources in the curriculum

A year 6 teacher, with a specialism in design and technology, has used Bloodhound materials in lessons throughout the academic year. In science and maths, they have used video clips, presentations and 'chatterboxes' downloaded for free from the website. However, they have also managed to make Bloodhound cross curricular, by asking pupils to write a diary entry from the perspective of the driver of the Bloodhound car for PSHE and through pupils drawing aerodynamic pictures for art. The school's approach particularly impressed Ofsted:

Ofsted were actually present in our school for one of these lessons and they loved it!

The teacher has also used Bloodhound as a theme with other year groups across the school during Science Week, which included children as young as 6 years old. The teacher says that the benefits of using Bloodhound resources has been that the pupils are more keen in maths, that they can understand more the relevance of what they are studying and this has had a knock-on positive effect on pupils' performance: 'Seventy-six per cent of the year 6s' writing was above average for their age group'. The teacher has also gone on to adapt Bloodhound resources and now has lesson plan ideas available online for other teachers to use as: 'not a lot gets them [the pupils] excited but they absolutely love them [Bloodhound activities]'.

Several teachers commented on the effectiveness of the free online resources:

Particularly the film clips worked well as they are short and snappy and the presentations provided a good overview and context to the work (Teacher 5)

[The website is an] excellent resource, well thought out and useful (Teacher 15).

Ambassadors, too, commented on the effectiveness of the resources, particularly the video clips and the Top Trumps cards.

4.5 Engagement with, and work of, Ambassadors

The Bloodhound education team have successfully engaged the commitment of a large network of Bloodhound Ambassadors. Some are supported by their employer to engage whilst others are giving up their free time to represent Bloodhound. Many of these independent Ambassadors undertake their Bloodhound work in addition to a full-time job, with a large number spending at least a day a month on their Bloodhound activities. They give their time freely as they are inspired

by the project and what it is attempting to achieve. As one of the Ambassadors consulted commented:

Quite a lot of Ambassadors invest a lot of time and I am one of them...It's a privilege to work alongside Richard Noble and Andy Green. It's great to be right there in the middle of it (Ambassador 4).

The enthusiasm and commitment of those Bloodhound Ambassadors consulted as part of the audit is impressive and all of them thoroughly enjoy their work for Bloodhound. As comments from teachers and partners suggest, the Ambassadors are very effectively inspiring the young people they work with. As one partner commented:

His [Bloodhound Ambassador] talk was fantastic. He enthuses kids so much that they want to be involved. He is a brilliant Ambassador with loads of energy (Partner 3).

Independent Ambassadors who have been supported by team members in the early stages of their work with Bloodhound have found this to be very beneficial. They have been able to 'shadow' the team members and get tips on presentation skills and how to engage the children. As one Ambassador commented:

When I started my Bloodhound career I wasn't used to public speaking. [Name of Bloodhound education team member] has been an absolute guru to me. He took me under his wing and gave me challenges (Ambassador 2).

A number of Ambassadors working within businesses that have made a corporate commitment to the Bloodhound Education Programme have commented on the effectiveness of having a network, or social community, of Ambassadors who support each other. One business has established a buddy system so that the Ambassadors always feel supported. As two Ambassadors commented:

There are always at least two of us [that go to a school or event]...The social community of Ambassadors works well (Ambassador 6)

The team work well together and support Ambassadors... It's great to see the feedback coming in. I have got this team who I look after who are doing really well and getting really good feedback and are enjoying what they are doing. They are always asking me what events are coming in... it makes me proud (Ambassador 7).

4.6 Engagement with partners

The education team have secured a significant amount of good will and have developed some very effective relationships with partners. As one partner commented:

They [names of two Bloodhound education team staff] are really brilliant and we work very well with them. I often go to [name of Bloodhound education team staff member] and he's always really really helpful and willing to chat through ideas. We have a very good relationship (Partner 5).

In particular, the Bloodhound education team are working effectively with private sector partnerships, colleges and a number of education focused organisations such as F1 in Schools, the Engineering Development Trust and Women in Science, Engineering and Technology. However, as mentioned later in section 6, some of their earlier partnerships now need revitalising.

5. Outcomes to date

A variety of outcomes have been realised for the range of beneficiaries of the Bloodhound Education Programme, as detailed below.

5.1 Outcomes for young people

5.1.1 Increasing young people's understanding of engineering and the importance of STEM subjects

Because engineering is not taught as a subject in most schools, young people's understanding of what engineering is, the different types of engineering, and what engineers do tends to be extremely limited. The Bloodhound education team's work makes engineering accessible and relevant to young people's lives and gives a real example of an engineering project in the UK. As a result, young people gain **a better and broader understanding of what engineering is and how important this work is to society**. As several partners, pupils and a teacher commented:

They gain a better understanding of engineering by the end of the day (Partner 7)

It makes them think about the world of engineering (Partner 9)

We learned about what it is like to be an engineer. I'll definitely follow up the progress of the car on the internet (Pupil Year 5/6)

I thought it was about sorting pipes out and stuff but I know now it's about building cars as well (Pupil Year 5/6)

I didn't know much about engineering before. I do now (Pupil Year 5/6)

They gain a greater understanding of the breadth of engineering (Teacher 5)

From our perspective the project fits well. It's great to see a body that is actually trying to promote design and engineers and design and creativity in this country but in the right way. They are not trying to promote design through old fashioned methods that we as a nation shouldn't be getting involved with as we can't compete. They are trying to inspire in the right way which is innovation and design in a way we can compete (Partner 16).

In addition, the Bloodhound education team's work brings together elements of science, technology, engineering and maths allowing teachers to make the Bloodhound project cross curricular in their schools and to **stress the links between these subjects, how they are applied and the importance of them to the nation's economy**. As two business consultees and a teacher commented:

It opens their eyes to what STEM actually is...Bloodhound brings the best of the technology that is available and puts it all in one package and says this is what can be achieved (business consultee 1)

They are using the car to reinforce the importance of education in engineering to the wider world (Business consultee 3)

They [the pupils] realise what science, engineering and maths are for and associate it with 'fun'...They forget what they learn is for, especially girls...It puts a lot of learning into a real life context. That's what we are always looking for and it doesn't come that easily and it was delivered on a plate – making the curriculum relevant for the children (Teacher 1).

5.1.2 Enthusing and inspiring young people about engineering (and STEM)

The Bloodhound project is seen as a fun and practical way of engaging young people, both male and female, with real life engineering work. The project succeeds in **exciting and enthusing young people about engineering and STEM** and encourages them to consider becoming more involved.

The message is always about inspiring the next generation of bright STEM students to choose engineering (Business consultee 3)

Providing real life example helps to make it relevant...Anything that inspires children's curiosity in this way is a good thing (Teacher 14)

They realise engineering is fun and we get some good results. The day is effective (Partner 7)

They do a really good job with the kids. The activities they do are really good. The 3D printing – it's exciting stuff. The kids love it! The whole concept of the education programme is really brilliant. I'm very proud to be part of Bloodhound (Partner 8)

It creates a lot of interest; it's an awesome vehicle and interesting project. It creates a lasting impression on pupils having seen it (Partner 1)

It was really interesting. I'm surprised how fast the car will go (Pupil Year 5/6).

As Bloodhound is attempting a world record it is inspirational for British young people in particular. Teachers and Ambassadors have commented that **being near aspects of the project's development has made it come alive to the young people as it is something that is happening in their country and in their community:**

They can make the connection for what they are learning in the classroom and what is going on outside. I think Bloodhound is a very important project for Bristol. It is right on their doorstep (Teacher 8)

It's such an inspirational project for this country and if they break the record it will be such a fantastic and inspirational achievement that young people can't help but be inspired. It's good to have something to contextualise why STEM is important and exciting...It's a brilliant project to engage students, absolutely superb...It is uniquely placed to be inspirational...They can't help but inspire the next generation (Partner 10).

Getting a chance to be involved in a **practical activity** based on Bloodhound such as building the balloon cars or rocket cars **adds to the children's enjoyment and interest** as it is something quite different to other school work. There is also an element of competition introduced to the practical sessions as students try to make their car travel furthest or go fastest. As several consultees commented:

The hands-on work they do is stimulating and exciting and very well supported by the Bloodhound team and Intel Ambassadors (Partner 12)

The competition element engendered more enthusiasm...this afternoon has been very good, practical and hands-on (Teacher at event)

I like building these [balloon cars]. They're really fun. I've not really built anything before (Pupil Year 5/6)

The activities that they offer to Key Stage 2 such as the balloon cars always go down really well and the workshops at the [Bristol] Education Centre are really good (Partner 5).

5.1.3 New learning and skills development

The Bloodhound Education Programme **helps young people to develop and practise a range of new skills** including teamwork, following instructions and working on a task, problem solving, and communication and presentation skills. They learn how the STEM subjects are applied in practice and activities on the Bloodhound theme have also been delivered in a range of other curriculum areas such as art, geography and personal, social and health education (PSHE). During the practical sessions, in particular, young people are also **acquiring new knowledge**. In developing and improving their cars, they are also thinking and learning about the aerodynamics of the car, design, speed and distance. As several consultees commented:

The balloon car activity is very very effective. The kids love it and it gets all the engineering principles across (Ambassador 5)

Understanding how things get developed and made is dreadfully lacking in schools...STEM is addressed very badly in schools. Bloodhound has made a substantial first base... It brings the subjects together with design and make (Partner 12)

The car activity was really wonderful. They got on and did it. It was about problem solving. Following the instructions worked fine (Teacher at event)

Being involved in a team challenge that is technical...they get involved in all the key skills, functional skills, improving their personal presentation, their verbal presentations and getting involved in graphic design work and things like that across the curriculum (Business consultee 4)

I think they have got a lot of enjoyment out of it. Also to become team members working in teams as pairs. Learning about different engineering aspects, the different components of cars and thrust and actually learning about maths with science as they are making and designing (Teacher 8).

5.1.4 Raising awareness of, and interest in, engineering jobs and careers

As part of their activities, the Bloodhound education team raise young people's awareness of the jobs and careers open to them in engineering and they challenge gender stereotypes. Where possible, **team members and Ambassadors bring the careers dimension into events, school and college visits** so that both young people and their parents are aware of what is on offer to them in the future and the path they need to follow to get there. As two consultees commented:

They saw around fifteen role models on the day and they saw how they got to where they are now from school and the stepping stones along the way (Partner 10)

I would recommend from an educational point of view for Bloodhound to be involved because they do completely understand that young people have this voice and that they should be encouraged to take part in engineering in the future (Teacher 11).

As part of their involvement in First Edition (see page 21 for further details), girls are often set a task of working out the skills and qualifications that are needed for different STEM jobs:

They [girls] learn about engineering jobs and what skills and qualifications are required for particular jobs. It's a good challenge and it breaks down stereotypes. It's a very effective part of the day (Partner 7).

As a result of raising young people's awareness of what engineering is about, some young people are inspired to consider pursuing engineering careers in the future. As several consultees commented:

Twenty per cent of our girls say they want to go into engineering, in part due to Bloodhound work (Teacher 10)

It was extremely effective...bearing in mind most of the girls were from Asian backgrounds and would not be encouraged to go into that sort of industry and seventy-two per cent of girls would consider going into that sort of career after that day (Teacher 11)

The girls said it had given them a really clear idea of what engineering is. That it had inspired some of them and that they definitely wanted to do it (Teacher 1)

I've always been interested in technology but I'm now more interested in engineering (Pupil Year 5/6)

The kids are inspired into engineering and creating and design through what Bloodhound is doing (Partner 16).

5.2 Outcomes for teachers

Although the main aim of Bloodhound's activities is to engage and inspire young people, there are some knock-on benefits for teachers. Through engaging with the Bloodhound project, **many teachers have experienced benefits in relation to developing their own knowledge and skills in STEM subjects and revitalising their teaching**. As an Ambassador pointed out:

You are educating the teachers in parallel with educating the children (Ambassador 3).

As mentioned in section 4, some teachers have embedded Bloodhound resources within the curriculum and using Bloodhound as a theme has allowed them to bring alive and demonstrate the practical application of STEM subjects. As one teacher commented:

Bloodhound has enabled us to deliver our activities in a more interesting and innovative way (Teacher 5).

One of the schools consulted is developing a Bloodhound challenge for feeder primary schools as detailed in the box below.

Schools can build on Bloodhound ideas to create their own projects

One Nottinghamshire secondary school is in the process of developing its own Bloodhound challenge for local feeder primary schools as a result of its engagement with Bloodhound. The initial involvement was through 30 girls from the school attending an event promoting women in science and engineering and they were given the chance to see the model car, try the driving simulator, take part in a discussion about Bloodhound and build and race the balloon cars. The teacher who attended the event commented that 'building the balloon powered cars was a 100% success'. Following on from this experience, one teacher and the engineering after-school club leader decided to adapt the balloon car exercise to include stomp rockets and create a competition for their local feeder schools:

We have taken the Bloodhound idea and created a practical challenge very much based on speed, and excitement has rippled through the school.

This challenge is now featured on the Bloodhound website and will also be included in their schools' bulletin, thus giving the school wider recognition for the work they are doing and promoting the school to the public. The school's head teacher and other teachers have now become involved with Bloodhound and they are planning to roll out Bloodhound work throughout the school.

5.3 Outcomes for Bloodhound Ambassadors

A range of outcomes have been realised for Bloodhound Ambassadors which are explored in the section below. All of the Ambassadors consulted said that they would recommend to others that they should get involved in the Bloodhound Education Programme.

5.3.1 Enjoyment and satisfaction

The majority of Bloodhound Ambassadors have mentioned that **personal satisfaction and enjoyment of the Bloodhound work has been a key outcome of their involvement**. Several of the Ambassadors mentioned that this was despite being daunted about the thought of going into schools at first. As two Ambassadors commented:

You get an awful lot back from them [young people]. It's brilliant!
(Ambassador 4)

I've had more out of Bloodhound than it has had out of me (Ambassador 2).

A number of the Ambassadors are real enthusiasts about the Bloodhound car and some were also involved in the predecessors Thrust2 (1983) and ThrustSSC (1997). Being involved as an Ambassador has helped them to get closer to the engineers who are working on the car:

It's a double plus for me. Whether there was an Ambassador programme or not I would have been following the Bloodhound programme. The fact that there is an Ambassador programme helps me get closer to the people that are doing the Bloodhound project (Ambassador 3).

5.3.2 Development of skills, knowledge and confidence

All of the Ambassadors consulted have mentioned that working as an Ambassador has involved developing some new skills and knowledge. These include: presentation skills; skills in communicating and engaging with children; IT skills (needed to develop and deliver presentations); and science, maths and technology knowledge. Many Ambassadors have commented that volunteering as an Ambassador has increased their confidence and, for those who are not currently employed, it has boosted their self esteem. As two Ambassadors commented:

It's been a massive learning curve and I'm thoroughly enjoying it. I've been surprised at my own abilities...It's nice to learn something new. Understanding how to do presentations is useful (Ambassador 4)

For personal development it's excellent (Ambassador 8).

5.3.3 CV building

Two Ambassadors have not been employed during their time as a Bloodhound Ambassador and they have commented that they feel that their **Bloodhound work has added to their CV**. Both have mentioned it at job interviews and one Ambassador felt that it had contributed to them being offered a new job. The other Ambassador had also been offered a job due to contacts made through Bloodhound work.

The box below provides an illustration of some of the benefits that have been realised for Bloodhound Ambassadors.

Benefits of being a Bloodhound Ambassador

A Bloodhound Ambassador who has worked with Bloodhound for eighteen months said that his work had given him back his self-respect and built up his confidence for public speaking whilst he has been unable to work full-time. He has attended over fifteen events as an Ambassador and has visited 30 primary schools, 10 academies and 5 secondary schools to give presentations and help children build balloon cars.

At Key Stage 2 you do the Bloodhound talk and the Top Trumps and their eyes are like out on stalks... and the balloon cars, they are absolutely fired up for it and that's my wages.

This Ambassador reports that the outcomes of being an Ambassador are that he has met a network of people, been able to use his STEM knowledge and that he has developed his presentation skills to a high level, sometimes speaking to over 300 people at a time. He also commented that the work had kept his CV alive and that he had even received a job offer from a college after presenting there as a Bloodhound Ambassador. He would definitely recommend to others to become an Ambassador.

5.4 Outcomes for businesses

A range of outcomes have been realised for businesses as a result of their commitment to the Bloodhound Education Programme. They are explored in the section below. All of the business consultees said that they would recommend to other businesses that they should get involved in the Bloodhound Education Programme.

5.4.1 Supporting the businesses commitment to increase interest in STEM and engineering

The majority of the business representatives consulted stated that a key reason to become involved with Bloodhound was to encourage young people into STEM subjects. One Ambassador commented that the business had engaged in Bloodhound 'in order to support our number one objective to reach out and inspire the next generation of scientists, technologists and mathematicians and partner to showcase both of our efforts' (Ambassador 6). A number of businesses commented on the complementary aims of their business and Bloodhound: 'Our businesses match well...They are all about inspiring future engineers or designers and we are all about giving tools for those future engineers and designers' (Partner 16).

Bloodhound allows businesses to have a more direct influence on schools and young people and is a 'vehicle' to raise young people's engagement in STEM and engineering. As two consultees pointed out:

STEM seems to be a recurring political theme...we want to develop a STEM story...Bloodhound is a vehicle for us to explore STEM (Business consultee 5)

It [Bloodhound] uses the car to reinforce the importance of education in engineering to the wider world...the message is always about inspiring the next generation (Business consultee 3).

5.4.2 Media coverage and PR

A number of businesses have engaged in Bloodhound to increase awareness of their business and for public relations reasons and they are realising their aims in this respect. **Three of the business consultees noted that working with Bloodhound had increased the media coverage and PR which they received.**

The publicity from working with Bloodhound has also enabled businesses to work more closely with schools than previously. For example, one business has been able to increase its activities with primary schools which had been small scale before. Another business had not worked with schools previously but, through their involvement with Bloodhound, they were moving into the education sector and now attending education events and reaching a different audience. As one consultee remarked: 'It has helped us get into a couple of schools that we couldn't get into before because of it being Bloodhound' (Business consultee 2).

Two of the business consultees commented that Bloodhound work had increased public awareness of what their business did. All of the businesses said that being associated with Bloodhound had improved public perceptions of their business, expressed by one business as 'shed a positive light' on the organisation (Business consultee 5). One consultee (Business consultee 3) noted that Bloodhound had particularly raised the profile of the business amongst the younger generation which reflected well on the business brand.

The majority of the businesses also said that being involved with Bloodhound was good for their corporate social responsibility. However, as part of this they wanted to ensure that they were engaging with, and supporting, young people. As one business consultee commented: '...but CSR is not enough... it's nice to know we are helping kids too' (Business consultee 5).

5.4.3 Increased staff satisfaction

Echoing the comments of their staff, several business consultees have noted that there have been benefits for their business as a result of staff volunteering as Bloodhound Ambassadors. In particular, they have commented on **increased staff satisfaction**, with three of the business consultees mentioning that their staff thoroughly enjoyed the Bloodhound work. As one consultee commented: 'It is nice to be associated with it [the Bloodhound project]...It has opened up opportunities [for staff] (Business consultee 2).

5.4.4 Engagement with stakeholders and increased business

Three of the businesses consulted mentioned that working with Bloodhound had increased engagement with their stakeholders. This included one business expanding further into international markets because of the global recognition for the 'iconic project' (Business consultee 5). Another mentioned that the organisation's involvement in Bloodhound had increased its business in colleges.

5.4.5 Future involvement

All of the business representatives said that they were keen to maintain strong links with Bloodhound, with two businesses wanting to keep their commitment at the same level and three looking to expand their work with Bloodhound, for example by introducing an Ambassador scheme for their employees. As one consultee commented: 'There is still a large potential to grow' (Business consultee 5).

The majority of the businesses also mentioned that the increased publicity and media attention as the land speed attempt grew nearer was a particularly attractive reason to carry on their involvement:

Phenomenal coverage will happen when the car is rolled out (Business consultee 3)

[There is] great PR coming out of it [working with Bloodhound] particularly as it gets closer to the record attempt (Business consultee 4).

This was in addition to all five businesses saying that the success of the work they had done so far meant that they wanted to continue this relationship:

We want to carry on as we are...it's a very good project with good impact (Business consultee 2)

I don't see another project in STEM making such an impact (Business consultee 5).

The box below provides an illustration of some of the benefits that have been realised for businesses as a result of their involvement in the Bloodhound Education Programme.

Benefits for businesses of involvement in the Bloodhound Education Programme

One business has made a commitment to the Bloodhound Ambassador programme and now has 44 Ambassadors spread across the country. The Bloodhound education team pass on information of upcoming events which is sent out to the list of Ambassadors to sign up for as they wish. Ambassadors have all received training which they found effective and which prepared them well for the role. The business ran an open day with almost 400 members of the public coming along to hear about Bloodhound, try the driving simulator and build balloon cars which raised public awareness of Bloodhound and the company. The business also regularly sends Ambassadors to primary and secondary schools to run activities there and Ambassadors also attend events like the BBC's 'Bang goes the theory' and 'STEM

in action'. Ambassadors asked the children at one school what they wanted to do when they grew up before and after a Bloodhound activity and '11 out of 60 changed their minds and wanted to be scientists and engineers'. The business consultee said that the Ambassadors had 'grown in confidence and had really enjoyed the events'. They would recommend that other businesses work with Bloodhound as 'it gets the staff motivated and gets the company name out there'.

6. Areas for development

The Bloodhound education team have undertaken a significant amount of work in a short time, which is particularly impressive considering the size of the team and the evolving nature of their work. However, there are some areas that they could improve and enhance which are detailed in the section below. The extent to which they will be able to action all of the areas mentioned will depend on staff capacity. As one of the partners aptly put it: 'They have not got enough staff for what they want to achieve, but who has nowadays?' (Partner 16).

6.1 Consolidation and action planning

The Bloodhound education team have been far reaching in their activities capitalising on a range of opportunities for partnership working and not turning down any opportunity to raise awareness of Bloodhound and engage young people in STEM. They have a small team of staff with limited capacity and it seems that **now would be a good time to consolidate their activities and develop a formal plan for the future**. This should include focusing on what they are really good at (such as the 3 day events in colleges, school visits and large events) and on areas that need further development, such as the online resources. The team are already focusing their energies on these key areas.

It is important to note that the Bloodhound education business is developing very fast with the team now working on initiatives which had not been considered 6 months earlier. There is no precedent for the education project and new and innovative developments are resulting directly from market response. Given these rapid changes and new opportunities developing, it is suggested that forward plans should cover the short-term (i.e. the next year, 2012/13), which the team are in the process of developing. So that they can be monitored, the plans will need clear aims, activities, success measures and intended outcomes and impacts.

6.2 Resources

The Bloodhound education team are aware that the number and range of resources has not changed significantly since the last audit in 2009 and that this is a key area for future development. In particular, teachers and Ambassadors have noted that a disproportionate amount of resources are suitable for Key Stage 2 in comparison to other levels and that **additional resources for the higher levels would be welcomed**:

We've been a bit disappointed at the speed in which relevant materials have been developed...It's partly a question of direction and knowing what schools need and I think they were a bit over-ambitious at the start (Partner 12)

Bloodhound say they have resources for all age groups but there seems to be more for Key Stage 2 (Business consultee 2).

This need for more resources at different levels of complexity has also been noted in relation to practical activities, with the balloon car activity being most frequently used by Ambassadors. Although the Bloodhound education team primarily focus on the younger age groups, more practical resources at the higher levels would be welcomed. The team are aware of this gap and, as mentioned in section 3, they are working with LSIS and with universities to increase the amount of materials suitable for young people at Key Stage 4, 5 and beyond and these materials should be available shortly.

In relation to primary and secondary schools, teachers appreciate the range of resources that are already available on the Bloodhound website but a number of teachers have commented that they are difficult to navigate and to match to the curriculum. To use the resources effectively, teachers need to make an initial time commitment to search through what is available and what is relevant to them and this can discourage them. **It would be useful if the resources could be ordered or catalogued more effectively and more closely matched to the curriculum.** This would help with accessibility and increase usage. This could include a more detailed introduction to the resource and more guidance on its aims. As several consultees commented:

They produce a lot of materials but they could be in a more usable format. It would be interesting to know how they would like teachers to use them. They need to be more user friendly... [Name of staff member] is aware of that (Partner 5)

You really need someone at schools to take these activities forward and engage with it all (Teacher 10)

They need to provide more content for schools to work with. It's easy to get their interest but to ensure they use the materials and make the most of the project is harder (Partner 4)

They could make the resources more useable by teachers (Partner 13).

In addition, it has been commented that additional resources could be developed for primary and secondary schools that more closely match the stage of development of the car and that additional practical exercises could be devised to supplement those already available:

The fuel system is going to deliver a bucket of fuel every second. It's phenomenal! What needs to be achieved is to break it down into a simple pressure experiment that can be done in the classroom. I've been using a bicycle pump. Bloodhound is a backdrop. I'd like to see more about the mechanics...You need to make it easy for teachers, particularly in primary. There are things that can be done easily and cheaply using the Blue Peter approach (Partner 13).

One way that the resource bank will be improved is through the new website that is being developed with the University of Southampton. The website will have a repository behind it which will be able to host a lot of engineering information and materials which the current website can not manage and it will enable teachers and lecturers to upload their own resources onto the site.

6.3 Follow-up with schools

Both teachers and Ambassadors have commented that **it would be helpful if more ongoing and sustained relationships were developed between the Bloodhound education team and schools**. This is already happening to some extent with Ambassadors and the team developing relationships with particular schools but, in some cases, schools' engagement with Bloodhound is through a one-off event and not followed up or capitalised upon. More ongoing contact would enable, and encourage, schools to embed Bloodhound into the curriculum and for it to be an ongoing theme that is returned to.

More ongoing contact with schools could be achieved through the Bloodhound education team returning to schools to facilitate further activities. However, this is time intensive and may not always be possible. It can also be achieved by further development of the resources, as mentioned above in section 6.2. The 'Ambassador in a Bag' resources that are currently being developed which Ambassadors can leave behind at schools, and an improved bank of resources on the website, should support schools' ongoing activities on the Bloodhound theme. Providing a package of resources at the end of a visit when both teachers and young people are fully engaged with the project would be very effective. As one partner commented:

They could improve on the follow-up which is what we are trying to do here. Breaking down the intransigence of teachers...You need to enthuse the teachers first, kids are no problems (Partner 13).

A more sustained relationship with schools will also support the achievement of longer-term impacts on young people which can be more easily measured.

6.4 Ambassadors

Another area of development is **increasing the levels of support for new Ambassadors and formalising a 'buddy' system**. Half of the Ambassadors consulted felt that they would benefit from having more support from Bloodhound particularly when they were new as many Ambassadors felt daunted or nervous about going into schools and some were not used to public speaking. One Ambassador suggested that having a formalised 'buddy' system for all new Ambassadors would mean that they always had some support whether this was from an experienced Ambassador or a member of the Bloodhound education team acting as a mentor:

I would suggest that Bloodhound Ambassadors could be more active if a buddy system was in place... it is daunting on your own. People are not used to talking to large numbers of kids...the network of contacts would be great (Ambassador 2).

In some cases, the buddy system is already operating, particularly within the businesses that have made a commitment to the Ambassador programme. In addition, some independent Ambassadors have been linked with a member of the Bloodhound education team and have benefited from support in relation to developing presentations and engaging young people:

[If the shadowing and mentoring support had not been available] I may not have got over the hurdle of getting up and talking to kids (Ambassador 3).

However, it would be useful if a buddy was allocated to all new Ambassadors.

As mentioned previously, the Bloodhound education team could also encourage all Ambassadors to make stronger links with their local schools, which is already happening in many cases. This would improve communication and support the development of more ongoing relationships, as mentioned above.

Other ways of supporting Ambassadors would be to set up a system to pay for the travel expenses of independent Ambassadors who do not benefit from their employer covering these for them. A number of independent Ambassadors have mentioned that the cost of travel has limited their involvement to some extent and that they would do more if expenses were paid. This may not be something that Bloodhound is able to action with its restricted funds.

Several Ambassadors have also mentioned the cost of materials for schools and the cost of having the display car during a school visit. One Ambassador commented that they found it awkward discussing the cost of materials with schools and would prefer it if someone in the central team could organise this for them.

6.5 Communication with stakeholders

All stakeholder groups have mentioned that **communication with Bloodhound education team members could be improved** (i.e. made more speedy and regular) to make working relationships more efficient and that the structure of the team and staff roles and responsibilities could be made more transparent. As an Ambassador and three partners commented:

I find it hard to know who is in charge... I don't know who to contact and what their role is (Ambassador 8)

It can be confusing who does what (Partner 7)

The project is constantly evolving as the job roles are and you don't always have continued communication with the same person which can be difficult sometimes to keep tabs on what's working (Partner 4)

There are some issues with internal logistics and communication. Coordination and communication could improve and that would make things easier for us. It can be difficult to get a response from some team members (Partner 5).

Communication with schools needs to be particularly effective as teachers are extremely busy and less likely to follow up on Bloodhound activities and events if the communication is difficult or slow.

6.6 Education Centres

The Bridgend Education Centre staff would benefit from more clarity as to its remit, including who it should target and activities that it might deliver. In addition, **a marketing plan for both the Bristol and Bridgend Education Centres is needed to ensure that they are fully utilised**. A key barrier that both of these centres will face is getting young people out of school due to time and travel cost barriers and consideration needs to go into how this barrier will be overcome.

In addition, it would be useful if a forum or network of centre managers was set up to enable them to share learning and good practice.

Several partners have commented that the BEP should now consolidate its education centre work. They have suggested that the team should put their efforts into making the existing centres effective prior to opening any more centres.

6.7 Partnerships

The Bloodhound education team have developed a large number of partnerships since project inception and this is a key area of strength. Many of these partnerships are very productive with both partners gaining from the collaboration. However, some partnerships are working less effectively which, in some cases, is linked to communication issues as mentioned above. This tends to be more the case with some of the earlier partnerships that the Bloodhound education team made which involved Bloodhound using DCSF funds to support partners to develop Bloodhound-themed activities and resources. A number of these partners feel that partnership working with the Bloodhound education team has not been as effective since the DCSF monies ran out. However, there is still a large amount of good will and desire to work closely with Bloodhound. As one partner commented:

I would be happy to host them and to use our networks and contacts to help Bloodhound. I would be very happy to act as a channel into local schools (Partner 2).

At this point in time, **it would be useful for the Bloodhound education team to review their partnership working and to develop a plan for partnership working from here on**. In addition, they have developed a 'memorandum of agreement' with some partners and it would be helpful if a similar type of formal plan could be

developed with other partners, particularly those with which it forged links early on. The plan should set out the basis of the collaboration and how regular communication will be maintained. As several partners commented:

It would be good to have a more formal arrangement (Partner 7)

We had a good relationship early on but now it is not so good...They should be looking sideways and seeing who can help. They are a small team and they are not working smartly with others (Partner 9)

Our work together has been ad hoc so far. We could do better at approaching Bloodhound. We would like to formalise the links more. That would be a good outcome (Partner 10)

It would be good to have a more formalised plan of activities...I want to be part of it and help as much as I can whenever I can (Partner 13).

7. Concluding comments

The work of the Bloodhound Education Programme team has evolved and changed since the last audit and, over the last two years, the small team have achieved a significant amount of work with very limited capacity and funds. In particular, the team have been particularly effective at engaging with a large number of young people in schools and colleges and tackling gender stereotypes.

The inspiring presentations and practical activities that the Bloodhound education team and Ambassadors facilitate provide young people with a better understanding of engineering and place their STEM learning in a real life context. For some, this is leading to an increased interest in studying STEM subjects and engineering in the future. The free resources available on their website are also being used by some teachers to embed Bloodhound within the curriculum and Bloodhound is in a unique position in that the information on the car and its development can be made freely available.

The education team have secured significant commitment from a number of businesses to their involvement in the Bloodhound Ambassador programme and to their support of events and Bloodhound resources. The commitment of the Ambassadors consulted as part of the audit is impressive and they are gaining much personal satisfaction from their involvement with Bloodhound, as well as developing knowledge and important skills such as giving presentations. Businesses which have made a commitment to Bloodhound are benefiting in a range of ways from their link to this unique project such as increased media coverage and PR, an entrée into schools and increased staff satisfaction. The Bloodhound team have also continued to develop strong working relationships with other partners with an educational remit such as F1 in Schools, the Engineering Development Trust and WiSET, LSIS and Silverstone Study Centre.

As with any initiative, there are areas which the Bloodhound education team could enhance and improve. They are a small team and they have been far reaching in their activities, capitalising on a range of opportunities for partnership working and grasping any opportunity to engage young people in STEM. At this point in time, it seems sensible for the team to review their progress to date and consolidate their activities, focusing on what they do particularly well (such as events and school visits) and areas that need further development, such as the online resources. The team are already working on developing further resources at higher levels and these new resources, together with improved cataloguing and introduction to the resources already available, should increase their reach and usage and enable schools, colleges and universities to embed more sustained work on Bloodhound within the curriculum.

The Ambassador programme is working well but building existing buddying systems offered by some employers into a more formalised buddying programme offered to all

Ambassadors would quickly improve levels of confidence amongst Ambassadors in working with schools and enable them to 'hit the ground running'. In addition, encouraging Ambassadors to forge ongoing relationships with schools would support follow-up work and longer-term impacts.

The Bristol and Bridgend Education Centres are at an early stage of development and now require more widespread marketing, as well as plans to overcome barriers in terms of pupils and students being released from schools and colleges. The Education Centre Managers would also benefit from a forum in which they could share learning and good practice.

Although the education team have developed some very productive working relationships with a wide range of partners, some of their early partnerships are in need of revitalising. In particular, these partners would benefit from more ongoing communication and a formal memorandum of agreement where it is not already in place. Being transparent as to staff roles and responsibilities and who to contact would support relationships with all of Bloodhound's stakeholders.

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