

Guide to examples of good quality STEM placements



CONTENTS

Introduction to this resource.....	3
Mott MacDonald.....	4
Royal Air Force.....	5
JNP Group.....	6
Connaught plc.....	8
Ardagh Glass.....	9
Industrial Software Limited.....	10
Programming a PLC to a train track (example of project).....	11
JRI.....	13
Wider Horizons sample programme.....	14
Acknowledgements and Further Information.....	15

In addition to this guide, further information may be found in the 'Quick Guide for STEM Work Experience Placements' and the Teachers TV Programme about STEM Subject Choice and Careers Role Models and Work Placements, available at:

<http://www.nationalstemcentre.org.uk/elibrary/resource/1622/quick-guide-for-stem-work-experience-placements>

<http://www.teachers.tv/videos/stem-subject-choice-and-careers-role-models-and-work-placements>

This guide has been developed through the STEM Subject Choice and Careers Project. It is designed to help employers, teachers, students and anyone involved in work experience develop strategies for creating good quality placements for young people aged 14–19. The guide can be used in conjunction with the Quick Guide for STEM Work Experience Placements which was produced in 2010 to give an overview of factors to consider when organising and offering work experience.

This guide contains examples of good practice which are intended to reflect a range of different placement type in small and medium enterprises, public sector organisations, large corporate environments and in a variety of STEM-related work experience. There are many examples of inclusive and exciting placements linked to STEM subjects which we have not had the opportunity to investigate further and include. Some of these can be accessed through the websites listed at the end of this publication. Themes included in this guide often reflect practice which is promoted by education business partnerships and other organisations, and efforts have been made to select examples which are relevant to STEM as well as highlighting equality and diversity.

The examples we have cited are all slightly different but include the following common themes which reflect good practice in any work placement, regardless of whether it is STEM based or not.

- having a named contact who is responsible for co-ordinating the placement
- ensuring that there is a named contact for the duration of the work experience
- providing a structured programme where the learner and the staff of the organisation know what is expected of them
- including a project or workbook which helps the young person identify what they have learned
- offering practical 'hands-on' activities within the bounds of health and safety
- building in some form of feedback so that the learner and the employer have an opportunity to highlight the positives and make recommendations for change

Some of the companies included in the guide were involved in the Wider Horizons, which was created to encourage more females into STEM related work experience activities. A sample programme was created for employers at that time and proved to be very popular. A copy has been included at the end of this guide.

All of the companies listed in this booklet have completed health and safety risk assessments administered either through their own systems and/or through the local work experience provider network.

For further information about these and other examples of positive STEM related work experience placements please contact: [Jill Collins at the Centre for Science Education, Sheffield Hallam University \(wiset@shu.ac.uk\)](mailto:wiset@shu.ac.uk)



Mott MacDonald is a leading global management, engineering and development consultancy that has more than 14,000 staff and works in 140 countries. In the UK, the consultancy has developed a programme of work experience which encompasses different areas of its business as well as enabling the placement student to complete a focused technical project. The aim is to provide students with an opportunity to apply and develop their knowledge via practice and provide an experience that would allow them to make informed decisions on both subjects for study at a higher level and on their future career path.

Created with the flexibility to allow students aged between 14-19 to complete, the project pack has been developed to accommodate varying levels of ability and confidence.

Key features of the Mott MacDonald programme include:

- Learning outcomes of the placement are negotiated with the young person so that they know what they can expect on arrival.
- Allocation of a “buddy” who ensures that staff are briefed and a structured programme is in place before the student arrives
- The student is given a project to complete which introduces them to the core business of the company and includes some hands-on activities such as computer aided design (CAD)
- Ensuring that the terminology used in the materials given to the student are easy to understand and allows them to learn about new processes and business language.
- The activities are linked to employability competences, for example – communications and IT which students are encouraged to consider when updating their CV on their return to school
- Targets for students are set at the beginning and reviewed at the end of the placement
- A presentation at the end of the week allows the staff to review what has taken place and help the student identify what they can do to build on the experience (e.g. find out more about engineering, update their CV regularly)
- Staff are aware of the benefits of providing a positive placement for the company and for themselves; it contributes to their own career and personal development as well as the company’s Corporate Responsibility contribution and can be used as evidence in bidding processes

For more about Mott MacDonald go to www.mottmac.com

Royal Air Force (RAF)

The RAF has developed a range of initiatives aimed at encouraging applications from a broader pool into all trades and professions. In the STEM arena there are particular programmes which the RAF has engaged in and one example is the work experience residential weeks for young women, these have been offered at RAF Cosford and the programme was developed with support from WISE and the UKRC (UK Resource Centre for Women in Science, Engineering and Technology). The programme has been adapted for delivery with boys from under-represented backgrounds and with girls who take part in a week focused on logistics activities. They were delivered at RAF Cranwell and RAF Halton respectively.

The RAF approach has been one where management commitment to the delivery of bespoke programmes for 'girls into engineering' was initially gained, to highlight the fact that more could be done to increase the number of applications for STEM roles. Gender equality training was initially delivered to senior managers at RAF Cranwell and then with instructors at RAF Cosford. This was aimed at highlighting how activities could be adjusted and involve more hands-on participation in an exciting and engaging way. Consultants from WISE and the UKRC supported the RAF team in identifying how areas of the programme could be made more participative so that girls had the opportunity to experience practical activities like removing an aircraft wing and wiring a test board. A workbook was written to tell them what they would be doing each day and help them identify the skills learned and how they might use them in their career planning.

At the end of the week's experience the families and teachers of the participants were invited to attend a celebration event where the girls presented PowerPoint slides outlining what they had learned. The individuals who undertook the engineering and logistics experiences also gained CREST awards which were presented at the event.

Key features of the RAF programme included

- ensuring that trainers coming into contact with the girls were aware of the programme and how their input could affect their future career choices
- linking up with nationally recognised organisations like WISE, UKRC, the Girls' Venture Air Corps and Generating Genius for advice and support
- providing a bespoke workbook which included career planning materials and information about what the learners would be doing each day plus a diary to record their thoughts
- a celebration event where families and teachers could find out more about what the girls learned during the week
- showcasing the programme throughout the organisation and in broader networks to ensure that clear messages about the RAF's commitment to encouraging a wider range of applications is clear

Websites:

www.raf.mod.uk/altitude

www.wisecampaign.org.uk/parents_and_teachers/work_experience.cfm



JNP Group

JNP is a consulting engineering company with offices around the UK. Staff at the Sheffield office have developed a programme aimed at ensuring that learners have a broad experience which includes some technical skills. The company is committed to ensuring that young people on placements with them have as much opportunity to undertake practical activities as possible and manage their time effectively in order to do this. A staff member has been given responsibility for organising and supervising the placements. He has devised a list of work experience training tasks which is used as a template for providing a young person with a varied and relevant programme of activities.

A feature of the JNP approach which are particularly worthy of note are the commitment of a senior manager to delivery of a good quality placement which he has delegated to a more junior staff member in order to give him the opportunity to develop supervisory skills. There is nothing haphazard about the placements organised at JNP, staff on site are clear about the lines of responsibility and the need to ensure that the learner has all the information she or he needs to complete the activities.

When possible, and within the confines of health and safety regulations, learners are taken on site visits to observe how the office based activities such as computer aided design (CAD) have an impact on company projects.

The work experience training tasks are

- 1) Induction forms, timesheet, PC system and intranet
- 2) CAD training – City & Guilds workbook
- 3) Paper bridge task – research bridge design and then build your own
- 4) Loading down on a house – work out wall line loads
 - use a list of material weights
 - house layouts and elevations
 - work out the line loads for each wall
- 5) Pile and ground beam House – design foundations for a house
 - draft up the pile and ground beams for the house in task 4
 - use the line loads obtained to work out the pile loads
- 6) Reinforced concrete – Simple RC detailing
 - create a RC drawing for the ground beams
 - create a bar bending schedule
 - do it by hand at first then CAD it up
- 7) Surveying – Use of level in car park, or on site if there is anyone going (Stephen Burrows is our resident expert)

- 8) Geotechnics – examine the history of a site and its surroundings to determine site conditions and risks from pollution, flooding and past mining.
- Using an existing envirocheck report
 - examine the historical maps
 - find out the geology using the BGS map
 - use the Environmental Agency website for flood Maps
 - use Google for a decent ariel photo
- 9) Cut and fill exercise
- 10) Topographical sections
- create section drawings using topographical level information (good CAD task as well)
- 11) Steel frame drawing using engineers calcsheets create a steel frame ‘stick’ drawing
- 12) Straw skyscraper task
- 13) Drainage levels – run through drainage layouts and details and put levels on an existing project.
- 14) Quantity surveying task – scale rule and calculator required
- 15) Travel plan task – maps of Sheffield required – use internet for up-to-date versions
- 16) Beam design task
- 17) Flood risk assessment task

Website:

www.jnpgroup.co.uk



Connaught plc

Connaught plc developed a work experience programme which was a shining example of how the whole company could benefit from engagement with young people. At the heart of the work programme was a commitment to involve a diverse range of individuals, both as ambassadors for the company and as participants of the scheme.

Initially the company suspended all work experience placements nationally as it recognised that the programme needed overhauling to improve its quality. A project team was established, consisting of personnel from several areas of the business plus some external education specialists. They included an adviser from Nottingham Education Business Alliance – the local education business partnership – and a co-ordinator from the UKRC which aims to encourage more women into STEM.

The project team agreed the following principles which were integral to the future success of the programme.

- to create a standard work experience programme and process that can be used as a model to roll out across the company
- to challenge stereotypes by designing a programme that incorporates and develops a wide variety of skills – such as customer services and quantity surveying – as well as the trade skills. Insisting that the schools promoted the placement to a more diverse set of learners.
- to ensure health and safety and child protection obligations were met
- to establish an internal staff development opportunity by creating a senior work experience ambassador and a work experience ambassador role
- to work with a small number of dedicated schools. These schools were The Dukeries School in Newark, a specialist construction school, and Quarrydale school in Sutton in Ashfield. Both were in the partnership works community.
- to run a pilot programme before going live, to provide a platform offering the greatest chance of achieving excellence
- to ensure that the students had a realistic experience to build their employability skills, including an application and interview process for the placement students

When the programme was rolled out it was built around a programme of engagement with local schools which reflected the customer base of the company. Connaught worked with the schools in a very pragmatic way by offering assemblies and hands-on activities such as tiling. They advertised work experience placements through a poster and application process which mirrored a real job application process and asked the schools to encourage applications from girls as well as boys.

Other key features of the programme were

- advertising within the company and recruiting work experience ambassadors to organise and supervise placements
- training ambassadors in recruitment and selection, health and safety and dignity at work, and through the STEM Ambassador Network which includes CRB checks and how to work effectively in schools
- ensuring that placements were offered to equal numbers of boys and girls in each region
- staying in touch with learners after the experience and tracking through to apprenticeships

Connaught plc went into administration in 2010

Ardagh Glass

Ardagh Glass is a global glass manufacturing company and supplies many of the world's largest food and beverage brands. The company employs around 6,500 people and produces in the region of 13 billion glass containers a year.

During the Wider Horizons project in South Yorkshire the Doncaster site hosted a placement aimed at encouraging more females into science, engineering and technology, where they are currently under-represented. The Doncaster plant is typical of many manufacturing companies and the technical and engineering areas where there is a predominantly white male workforce, the majority of who are over 40. Wider Horizons placements were aimed at encouraging girls who had opted for traditionally female work experience, such as administration, to try something new linked to science engineering and technology.

Health and safety is always a key factor in organising a work experience placement and it was clear from the outset that the learner would not be able to work in certain areas of production, particularly at the 'hot end'. The company was keen to ensure that the placement participant could undertake a project, and they asked her to complete an analysis of the existing workforce by gender, ethnicity and age.

Throughout the two week period she spent time based in the Human Resources Department, supervised by one of the women in the team. However she also completed tasks within the store's department, with the engineering technicians, in the 'cold end' and in other areas of the company. At the end of the placement the student presented her findings regarding the profile of the workforce to the HR team which included the following statements

- I learnt about the different roles of the different employees
- I learnt that I don't want to be an electrical engineer
- I learnt that I don't mind the heat, grime and dirt of the shop floor
- I learnt that there are very few females in engineering jobs
- I learnt that I would consider becoming an engineer as one of my possible career options

Key features of this placement were

- allocating one member of staff responsible for the day-to-day management of the student
- completing a project during the two week period
- presenting the project
- spending time in various departments to gain an overview of the organisation
- a commitment by the HR department to offer more placements which encourage females to find out more about engineering and technical roles

Website:

www.ardaghglass.com



The company develops software for industrial applications and employs about 12 people. The company has two directors who share management responsibilities. One is a woman who is an engineering consultant and advisor in a college nearby and takes the opportunity to act as a positive role model for girls thinking about engineering and ICT careers. Work experience is offered through local schools and colleges. The company has hosted mainly male learners and would welcome more applications from females.

The activities developed for learners on placements at Industrial Software are technical in nature and the job description given to learners is very clear about this. An excerpt from the job description is contained below.

Website:

www.industrialsoftwareltd.co.uk

Work Placement – Junior Design Engineer

The Company:

Industrial Software Ltd is a fast growing company specialising in providing industrial systems application software to both blue chip and smaller clients. This includes the design, installation and commissioning of control systems software ranging from pharmaceutical manufacturing plants to rollercoasters.

Job Description:

The candidate will be part of the engineering team and will be given basic programming tasks to help the team meet project deadlines. It is essential that the candidate have the ability to integrate well with the team as well as being self-motivated and willing to expand their knowledge.

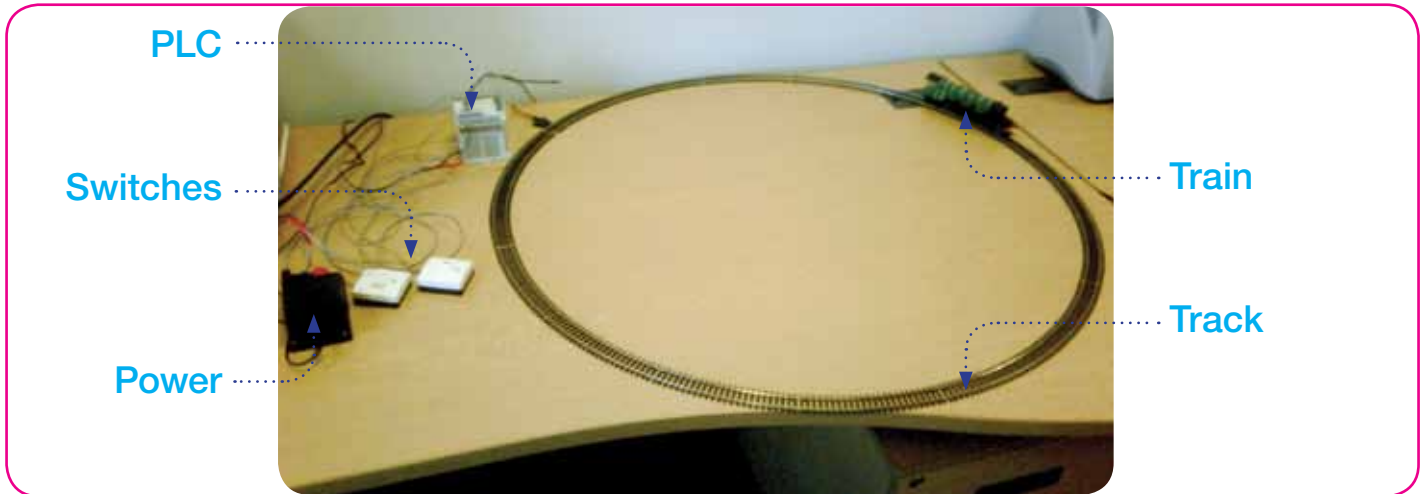
Duties will include (dependent upon the project timeline):

- Introduction to basic control systems and an overview of the types of software that Industrial Software produce and the hardware utilised (ie PLCs - Programmable Logic Controllers, HMIs - Human Machine Interfaces, SCADA - Supervisory Control & Data Acquisition).
- Help produce software design manuals and test procedures.
- Spreadsheet data entry.
- Produce basic HMI/SCADA graphics. The graphics represent the 'shop floor' process that is controlled and monitored by the control system software.
- There may be the opportunity to visit a site where a control system is being installed and commissioned (at customer discretion). If allowable this would be with a senior ISL engineer and the candidate will be 'shadowing' to see first hand how a control system is commissioned, the candidate will not be operating any controls.

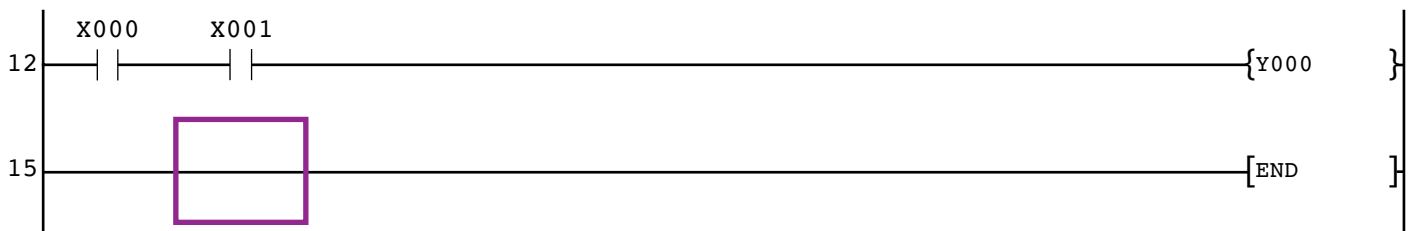
The following is a project which a young person at the end of their work experience placement at ISL.



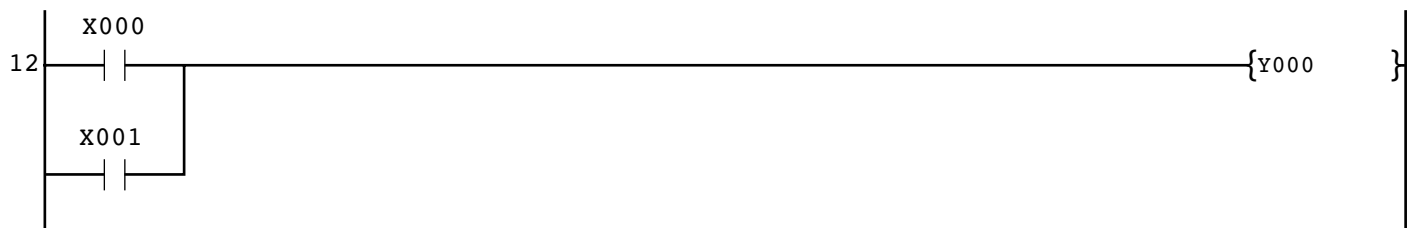
Programming a PLC to a Train Track

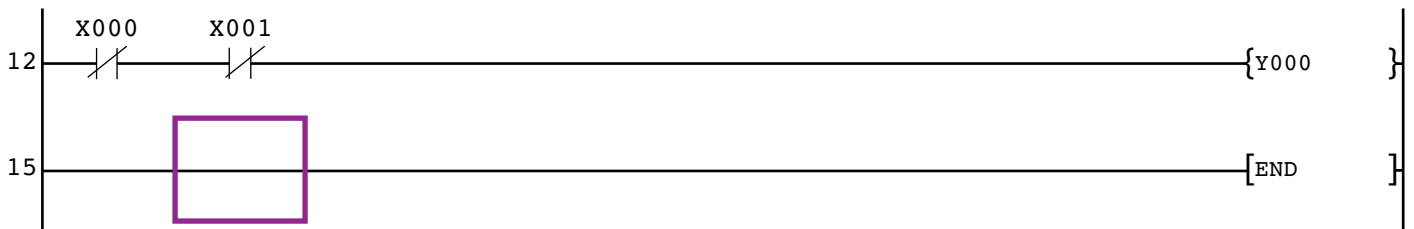


I have programmed a Mitsubishi PLC by using Melsoft GX Developer to make a train on a track move by just flicking switches, firstly, I programmed the PLC to make the train move when both of the 2 switches were on. Displayed by the picture of the first program shows 2 switches open (X0 and X1) and at the end of the line there is the 'Train Power' (Y0). The train would only move if both of the switches were connected, if X0 was on but X1 wasn't, it wouldn't work, so both switches would have to be on for the train to move, because there is only one line for the power to the train to move on, there is no other possible way for the power to get round and open switch.



I have programmed a Mitsubishi PLC by using Melsoft GX Developer to make a train on a track to move by presses either of the switches, so only one switch needs to be pressed down for the train to move around the track. As shown on the picture below, there are 2 switches, one under another, so if the bottom switch is turned on, it will go around the first switch and go straight to 'Train Power' same with the same switch, it will miss the bottom switch and go straight to the 'Train Power'.



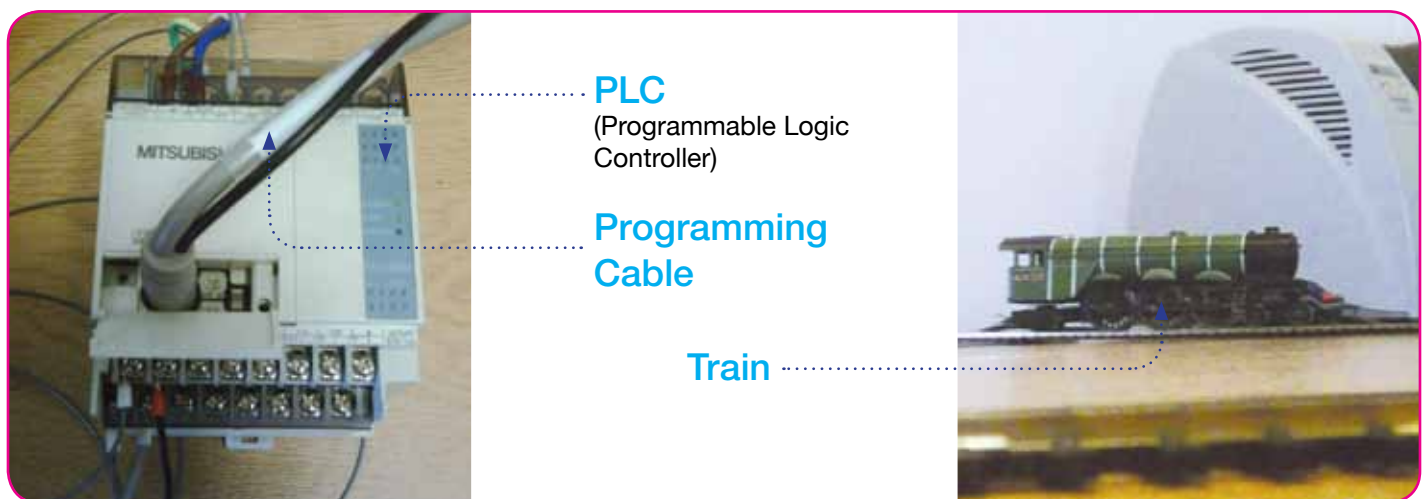


I have programmed a Mitsubishi PLC by using Melsoft GX Developer to make a train on a track to move by having both of the 2 switches off at the same time and no switches on. This works just like the first one but with different contacts, the first 2 contacts were switches with nothing between, but the picture below shows the different contacts used for a different purpose.

To make sure that all of the circuits worked, I used something called a 'Truth Table' on the last PLC that I programmed which gives me a certain amount of tests to take out which usually only 4 with the tables above.

1	1	0
---	---	---

X1	X0	Y0
0	0	1
0	1	0
1	0	0



Joint Replacement Instrumentation Limited is a British manufacturer of orthopaedic implants and surgical instrumentation (including replacement hip, knee and other joints). Operating from its Sheffield base JRI is a leading manufacturer and supplier of innovative products designed to meet the challenges of joint repair and replacement.

JRI has a history of offering varied work experience placements which offers learners an opportunity to find out about different roles in a number of departments. An example of the programme is shown below.

Itinerary for Work Experience Student

Date	Department and Activity		Person(s)
Monday 22nd June	Morning	Science Exam at School. Introductions and Inductions inc H&S	DD/DN/MJ/AT
	Afternoon	Continue above – Technical Projects overview	AC/AK
Tuesday 23rd June	Morning	Maths Exam at School. Quality Department – administration, training, suppliers, visual standards, Library, records, document control, calibration	SD/MB/AK
	Afternoon	Quality Department continued – complaints, NCs, standards, regulation/legal, MHO training	BS/DN/DD
Wednesday 24th June	Morning	Design Department – general housekeeping and introduction to design activities	MB/JT
	Afternoon	Continue design activities (2D CAD work and introduction to 3D).	MB/JT
Thursday 25th June	Morning	Ceramic Department – supervised activities	IH
	Afternoon	continue in Ceramic Department	
Friday 26th June	Morning	Customer Service and Dispatch – supervised activities and general housekeeping	DR/HK
	Afternoon	Continue in CS & D	
Monday 29th June	Morning	Metrology – general overview – supervised use of some testing equipment if possible	SJ/JT
	Afternoon	Continue in Metrology	
Tuesday 30th June	Morning	Cleanroom access and supervised activities	LS
	Afternoon	Continue in Cleanroom	
Wednesday 1st July	Morning	Goods Inwards and Stores	IP/JM
	Afternoon	Continue in Goods Inwards and Stores	
Thursday 2nd July	Morning	Shop Floor – production in cup/head cell, supervised use of some programmes (e.g. blasting for instance?)	CO/PB/SF
	Afternoon	Shop Floor – other cell activities – e.g. Plastics time/activities permitting or time in Polishing	
Friday 3rd July	Morning	Production Scheduling, Control & Engineering – introduction and activities	JS
	Afternoon	Continue in Production Office – close out plenary	AM/CB/PS/JP

Sample Wider Horizons programme

A Baldwin & Co

	Morning Activity	Staff Member	Afternoon Activity	Staff Member
Mon	Induction & Health & Safety briefing	Martin Hill	Observe reception area	Receptionists
Tues	Accounts Department	Accounts team	Contracts Department	Contracts Manager
	Visit various worksites	Tenant Liaison Officer	As per morning - with Tenant Liaison Officer	TLO
	General Office Duties	Finance & Admin team	Continue in general office - can spend time on workbooks	Finance & Admin team
Fri	Visit Depot/s (Wortley/Hunslet) to observe work planning, maintenance/social housing contacts	Martin Hill	As per morning	
Mon	Meet Marketing Team to discuss powerpoint	Ian	Meet Holly, plumber	Holly
Tues	Visits with Site Supervisor	Site Supervisor	As per morning	
	General Office Duties	Finance & Admin team	Continue in general office - can spend time on workbooks	Finance & Admin team
	Visit other departments - Engineering, Joinery, Plastics, Glass, etc	Department Managers	Free time for student to revisit any departments or plan activities she is interested in.	
Fri	Marketing team for support with powerpoint presentation	Marketing team	Finalise powerpoint slides and meet with Martin Hill for debrief	Martin Hill

Notes

- The student can use spare time to complete elements of the two workbooks she will be issued with.
- If alternative activities arise during the fortnight (eg a presentation by the marketing department) then the timings may need to be adjusted to accommodate this - it is important that the experience is varied and interesting and the schedule can be flexible to reflect this.
- The student will be asked to prepare a powerpoint slide show which they will present to parents, pupils & staff on their return to school from the placement. It would be ideal if a member of the marketing team (or someone with experience of preparing presentations) could support the student in this activity. The student will be issued with a disposable camera to collect photographic evidence of activities.
- Any other female role models in non-traditional roles could be introduced to the student as appropriate (eg outside contractors on site - particularly professional/technical level).
- If this format is not practical for operational or staffing reasons it can be adapted and is only intended as a guideline.

Executive summary for Wider Horizons are available at:

www.wiset.org.uk/index.php?mact=News,cntnt01,detail,0&cntnt01articleid=63&cntnt01returnid=26

Acknowledgements and further information

Kathryn Close, Mott MacDonald

Squadron Leader Glyn Dean, RAF

Derek Smith & Stephen Burrows, JNP Group

David Hinchley-Robson, Connaught plc

Melvin Pyle, Ardagh Glass

Zoe Cooper, Industrial Software Ltd

Paul Stocks, JRI Ltd

Further information about work experience placements can be found in the following.

For further information about these and other examples of positive STEM related work experience placements please contact: [Jill Collins at the Centre for Science Education, Sheffield Hallam University \(wiset@shu.ac.uk\)](mailto:wiset@shu.ac.uk)

A Quick Guide for STEM Work Experience Placements – available at www.nationalstemcentre.org.uk/elibrary/collection/207/stem-subject-choice-and-careers

www.rsc.org/Education/SchoolStudents/careers.asp – careers pages from the Royal Society of Chemistry, including pages on work experience placements.

www.britishecienceassociation.org/crest – gives information on the different levels of CREST awards and how they can be achieved.

<http://www.hse.gov.uk/youngpeople/workexperience/placeprovide.htm> – specific information for work experience placement providers.

www.nhscareers.nhs.uk/workexperience.shtml – a page on the NHS careers website where the downloadable pdf version of the work experience pack is available with useful mythbuster page and information other organisations may find useful.

www.direct.gov.uk/en/EducationAndLearning/14To19/Years10And11/DG_10013569 – government website containing useful guidance about work placements and links to other sites. Aimed mainly at young people.

www.iebe.org.uk/index.php/business – the Institute for Business Excellence was launched in June 2009 and brings together individuals and organisations working in the space between education and business.

<http://www.employers-guide.org/> – The Employers' Guide has been designed to help employers of all types and sizes to work more closely with schools and colleges.

<http://www.education.gov.uk/publications/standard/publicationdetail/page1/DFES-1471-2005> – This booklet offers general guidance and practical advice on the main issues relating to work experience placements for students in their last two years of compulsory schooling.

<http://www.cbi.org.uk/pdf/timewellspentbrief.pdf> – “Employability and work experience: a quick guide for employers and students” outlines the competencies that make someone employable and ideas for employers on how to improve development of employability during work experience

www2.warwick.ac.uk/fac/soc/cei – the Centre for Education and Industry is involved in research and teaching in work related learning, vocational education and training, and enterprise education.

Centre for Science Education

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Sheffield S1 1WB

Phone 0114 225 4870

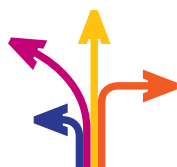
Fax 0114 225 4872

www.shu.ac.uk/cse

A Department for Education initiative to promote subject choice and careers in Science, Technology, Engineering and Maths (STEM) delivered by the Centre for Science Education at Sheffield Hallam University and Babcock

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