

CaMPUS Placements: UK Industrial - Reports 2011

Below are reports on the Summer Placements provided by students who participated in the scheme in 2011.

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PA Consulting, Melbourn, Cambridge

1. General

Placement Location: **PA Consulting Group**

Arrival and Departure Dates : **From 1-7-2011 to 30-8-2011**

No. of working days spent at Institution: **40 days**

2. Financial

Where did you stay during your placement (town name)?: **Downing College, Cambridge**

Total cost of daily travel to and from Institution (£): **£130**

Total received from Institution (£) : **£2000**

3. Research Project

Title of Research Project : **N/A**

Written Report submitted to host institution?: **No**

Experimental Techniques used: **N/A**

Interest level of project: on a scale of 1 (low) to 10(high): **10**

Quality of support provided: on a scale of 1 (low) to 10 (high): **10**

Interaction with other researchers: on a scale of 1 (low) to 10 (high): **10**

Short summary (~ 200 words) of technical content of project:

Although the placement in PA Consulting Group focused on the application of physical science in general, rather than directly related to materials science, the experience is very valuable to me. During the placement, I was given opportunities to work for three different projects and all the projects gave me great satisfaction.

The first project, which lasted for 3 weeks, is for a medical device and I was asked to design the mechanical system of it. With the support from my supervisor David Cross, I came up with an innovative system, which has not been patented in the industry. My second project is a short evaluation task on new battery technology. My final project, which lasted for 5 weeks, is to recommend how to modify a system to eliminate battery from a household device. I presented my findings which includes five physically practical solutions to my supervisors.

Sagentia, Harston, Cambridge

1. General

Placement Location: **Sagentia, Harston Mill, Harston, Cambridge, CB22 7GG**

Arrival and Departure Dates: **15/08/2011 – 23/09/2011**

No. of working days spent at Institution: **30**

2. Financial

Where did you stay during your placement (town name)?: **Cambridge (Selwyn college student accommodation)**

Total cost of daily travel to and from Institution (£): **£4.70/day**

Total received from Institution (£) : **£300/week**

3. Research Project

Title of Research Project: **Not applicable.**

Written Report submitted to host institution?: **None.**

Experimental Techniques used: **The experience I had was not in research but just in working in the different sectors that the companies worked in. I did not actually run any experiments or carry out any research – see detail below.**

Interest level of project: on a scale of 1 (low) to 10(high): **6**

Quality of support provided: on a scale of 1 (low) to 10 (high): **9**

Interaction with other researchers: on a scale of 1 (low) to 10 (high): **10 (very high interaction with all the employees)**

Short summary (~ 200 words) of technical content of project:

I did not actually undertake a research project during my time at Sagentia. In my opinion it was more a work experience placement than a research placement.

I worked on a wide variety of projects that Sagentia was working on. This allowed me to gain an understanding on all the types of work the company does and to understand how a consultancy works. The types of tasks I undertook varied greatly too. I have outlined the main projects/tasks I was involved in and the content of each:

- **desk-based research e.g. looking into patents on technologies already in use for similar applications to those intended in the technology Sagentia was developing.**
- **online research on scientific papers about psychology of usability error in medical devices**
- **sourcing seasonal variation in soil and air temperature data across different climate zones**
- **helping compile a client report on the best locations to outsource manufacturing**
- **writing technical notes for clients on specific technologies**
- **‘Technology Scouting’ – finding and contacting suppliers on specific parts needed for a new product**
- **presentation skills training – I undertook a two day training course on presentation skills**
- **I ran one small experiment to determine the flow rate and pressure of water through different nozzle types**

Overall there was a general underlying ‘scientific’ content to all the work I did, however, I did not actually undertake many experiments (only one very small one) and the work did not relate much to the Natural Sciences IA course.

Despite the placement not having a lot of experimental research, I still really enjoyed my placement at Sagentia. The company was very supportive, the work relatively interesting and I now understand how science and technology principles are applied in the business sector such as in consultancies, rather than just in academic research.

(On a side note though, I do know that there were other students who did do more experimental work– although they were in the Mechanical Engineering Sector of the company, whereas I was working in the ‘Science & Technology’ Sector.)

Granta Design, Cambridge

Report 1

1. General

Placement Location: **Granta Design**

Arrival and Departure Dates: **04/07/11 - 06/09/11**

No. of working days spent at Institution: **46**

2. Financial

Where did you stay during your placement (town name)?: **Cambridge (My College)**

Total cost of daily travel to and from Institution (£): **0 (Bike)**

Total received from Institution (£): **2415**

3. Research Project

Title of Research Project: **Polymer Database Development**

Written Report submitted to host institution?: **Kind of (in the form of a database with the new entries on)**

Experimental Techniques used: **N/A - Literature review**

Interest level of project: on a scale of 1 (low) to 10(high): **9**

Quality of support provided: on a scale of 1 (low) to 10 (high): **9**

Interaction with other researchers: on a scale of 1 (low) to 10 (high): **7**

Short summary (~ 200 words) of technical content of project:

Adding "folder level" information to the polymers section in CES Selector. I.e. adding a descriptive section for each polymer to provide information that the datasheet figures cannot - e.g. is polymer x or y better for intricate injection molding. The materials concerned were the entire polymers section of CES Selector, including thermoplastics, thermoplastic elastomers, thermosets and thermosetting elastomers, with some new ones added. Strengths and weaknesses were compared and key differences of peer polymers and information on how the properties change with differing chemical constitution (for co/terpolymers) were compiled. Other tasks for the folder level entries included finding first production dates and annual world production figures, providing chemical information (structures and restricted substances data) and some figures for Hansen solubility parameters. Once assembled, the information was put into a new database and the arrangement tweaked.

Report 2

1. General

Placement Location: **Granta Design**

Arrival and Departure Dates : **04/07/11-12/08/11, 30/08/11-16/09/11**

No. of working days spent at Institution: **45**

2. Financial

Where did you stay during your placement (town name)? **Sawston**

Total cost of daily travel to and from Institution (£): **£150**

Total received from Institution (£): **£2350**

3. Research Project

Title of Research Project: **CES Selector/Edupack Help files and Science Notes**

Written Report submitted to host institution?: **No**

Experimental Techniques used: **N/A**

Interest level of project: on a scale of 1 (low) to 10(high): **7**

Quality of support provided: on a scale of 1 (low) to 10 (high): **8**

Interaction with other researchers: on a scale of 1 (low) to 10 (high): **N/A**

Short summary (~ 200 words) of technical content of project:

My first two weeks were spent converting the equations in the CES Selector/Edupack help files into a more convenient format. The current equations in CES are difficult to read (small font, italics) and difficult to edit (currently stored as image files).

To improve the legibility and ease of formatting, I typed up all the equations into an Adobe Framemaker (publishing software) document, complete with heading and description (including what the equation is used for and an explanation of all the symbols used).

My main project was to investigate writing "Science Notes" (the scientific explanations of all attributes listed in CES datasheets, e.g. density, Young's modulus, etc.) for a new CES Edupack Level 1 database. Level 1 is the company's most basic materials database that only lists around 70 materials and subsequently needs simple Science Notes to explain material properties to younger students. CES has existing Science Notes, but some require up to 3rd year university knowledge to understand.

This project involved:

- **Researching what level 6th form/1st year science and engineering students are at**
- **Reading and understanding the current Science Notes**
- **Researching the attributes online to find more info**
- **Several group meetings to discuss ideas with other people**
- **Taking out complex ideas/maths/diagrams to simplify them for younger students**
- **Rewriting many parts of the current Science Notes to make the content relevant**
- **Adding new text (sentences/paragraphs/entire pages) to help explain concepts**
- **Editing and creating many diagrams to help explain concepts**
- **Re-reading and editing my own work many times until the final product was created (took 7 weeks of work)**

Report 3

1. General

Placement Location: **Granta Design, Cambridge**

Arrival and Departure Dates : **4th July -16th September**

No. of working days spent at Institution: **50**

2. Financial

Where did you stay during your placement (town name)?: **Bedford (at home)**

Total cost of daily travel to and from Institution (£): **£5/day**

Total received from Institution (£): **£2692**

3. Research Project

Title of Research Project: **The New, Emerging and Unusual ('NEU') Materials Database,**

Using CES Edupack as an Analytical tool (Reverse Engineering)

Written Report submitted to host institution? **White paper written on NEU database and report on using CES Edupack as an Analytical tool**

Experimental Techniques used: **none**

Interest level of project: on a scale of 1 (low) to 10(high): **8**

Quality of support provided: on a scale of 1 (low) to 10 (high): **8**

Interaction with other researchers: on a scale of 1 (low) to 10 (high): **7**

Short summary (~ 200 words) of technical content of project:

The New, emerging and unusual materials ('NEU') Database

The NEU database is a development database for the Cambridge Engineering Selector (CES) Software. Most CES databases focus on established materials, where as the NEU database aims to give information about new and emerging materials e.g aerogels, shape memory alloys, metal foam, nanocomposites. The steps in the project were

- All the data in the NEU records was checked against all reference (mainly professional journals and some manufacturer's datasheets)
- The software was updated to 2011 software ready for beta release
- 5 materials records were written and added to the database, (Nanophased Iron-copper, Nanophased Copper-Alumina, Nanophased stainless steel, PEEK-carbon nanotube composite, PC-carbon nanotube composite)
- An updated white paper was written for the database
- A PowerPoint unit, and exercises with worked solution, were produced as teaching resources to go with the database

Reverse Engineering project

The aim of reverse engineering is to identify an unknown material, by measuring simple properties with known precision, and then plotting these ranges on CES property charts to see what materials they correspond to, the aims of the project were –

- To find the precision ranges in hardness and density needed to give adequate resolution
- Find other simple tests to help identify the material e.g. approx melting point? does it burn?

Report 4

1. General

Placement Location: **Granta Design Limited**

Arrival and Departure Dates : **July 4th –September 16th 2011**

No. of working days spent at Institution: **55**

2. Financial

Where did you stay during your placement (town name)?: **Cambridge**

Total cost of daily travel to and from Institution (£): **3.5 (bus)/day**

Total received from Institution (£) : **Around 3000**

3. Research Project

Title of Research Project: **Extension of Fillers and Composites database**

Written Report submitted to host institution?: **Informal report**

Experimental Techniques used: **Computer skills – use of various software**

Interest level of project: on a scale of 1 (low) to 10(high): **8**

Quality of support provided: on a scale of 1 (low) to 10 (high): **10**

Interaction with other researchers: on a scale of 1 (low) to 10 (high): **7**

Short summary (~ 200 words) of technical content of project:

The aim of my project was to develop the composite-based records within the company's database. The focus of my work was on functional fillers and natural fiber composites. I started with general research on the properties of the materials from books, journals and websites and a lot of data points were collected from a number of sources. Data analysis was then carried out including the numerical analysis and graphical display. The finalized data of mechanical, thermal and electrical properties of around 15 different materials were imported into the database. The

next part of my project was to run some case studies. I used the hybrid synthesizer tool in CES selector software, which allowed me to input data of fillers and matrix respectively and generate the properties of the composites. A number of case studies were then done comparing the data I found from my research and the results obtained using the models in the hybrid synthesizer tool, as well as the records already in the database. Overall, I created new records about materials properties in the database and checked them by carrying out different case studies.

Report 5

1. General

Placement Location: **Granta Design, Cambridge**

Arrival and Departure Dates: **04/07/2011 – 16/09/2011**

No. of working days spent at Institution: **55**

2. Financial

Where did you stay during your placement (town name)?: **Cambridge**

Total cost of daily travel to and from Institution (£): **£0**

Total received from Institution (£): **£2570**

3. Research Project

Title of Research Project: **Hybrid synthesizer summer project**

Written Report submitted to host institution?: **Presentation given to company**

Experimental Techniques used: **Use of C# computer program to write model plug-ins**

Interest level of project: on a scale of 1 (low) to 10(high): **7.5**

Quality of support provided: on a scale of 1 (low) to 10 (high): **8**

Interaction with other researchers: on a scale of 1 (low) to 10 (high): **7**

Short summary (~ 200 words) of technical content of project:

The project involved developing the 'Hybrid Synthesizer' tool, which is used in Granta Design's CES Selector and CES EduPack software products. The Hybrid Synthesizer is a scoping tool that can be used to model the properties of hybrid materials such as foams, sandwich panels and fiber composites. It allows quick evaluation of the main mechanical, thermal and electrical properties of a hybrid material and therefore enables the user to explore new solutions or ideas to a particular problem.

My task was to develop the Synthesizer by creating user editable versions of the existing models, writing new models and then updating the relevant help information. The existing models were for open cell foams, octet lattices, balanced sandwich panels and unidirectional, quasi-isotropic and particulate composites. I created new plug-ins to model: closed cell foams, honeycombs (both extruded and expanded), unbalanced sandwich panels, multilayer laminates (from 2 to 7 layers), composite laminates, short fiber composites and a relatively new type of novel bi-material lattice structure that can have a 'tunable' coefficient of thermal expansion.

Writing new models involved researching the model equations (simplifying and approximating where appropriate), writing the code in C#, testing the model against existing data and then documenting relevant help/information for users.