

THE WINSTON CHURCHILL MEMORIAL TRUST OF AUSTRALIA

Report by - JENNIE YOUNG - 2005 Churchill Fellow

“To study schools in Europe and the USA with specialised space, aerospace and astronomy curriculum”

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Signed

Jennie Young

Dated

1st July, 2006

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INTRODUCTION

It is generally acknowledged that tertiary enrollments in science and engineering courses are declining. If this trend continues, Australia will suffer a serious skills shortage in key areas relevant to our increasingly knowledge-based economy. In order to ameliorate this problem, a method must be found to inspire secondary students to undertake the relevant preliminary courses. Such a method would ideally harness the youthful enthusiasm for areas such as space and engage them early on in practical activities, which they would then want to pursue.

This Churchill Fellowship project involved visiting schools in Europe and the United States, where such endeavours are extant. These programs have obtained favourable results, but quantitative data is difficult to access due to such inhibitors as privacy laws. While information channels on the success rates are therefore necessarily informal enough data has been received by individuals I spoke to, to substantiate the merits of the programs.

Many of the approaches and techniques in using space in education as a motivator could be readily applied to Australian schools.

I would like to thank:

- The Winston Churchill Memorial Trust
- Mr Hugo Larsen and Ms Ellen Ingebrihtsen at Andoy Videregaende Skole, Norway
- Herr Bernhardt Brauner, formerly of Friedrichs Gymnasium, Herford, Germany
- Ms Charlene Hirotsu and Mr Kirk Palayan of Thomas Starr King Magnet Middle School, Los Angeles. I would also like to pay tribute to the late Mr Steven Dworetzky, whose innovative teaching was an inspirational influence.
- Mr Ron Keating and Mr Thomas Kill of Westchester High School, Los Angeles
- The staff at Northeast Magnet School, Wichita
- The organisers of the International Space Development Conference.

EXECUTIVE SUMMARY:

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Project Description and Highlights:

The purpose of the project was to visit schools in Europe and the USA with specialised curriculum in the areas of space, aerospace and engineering, in order to observe how space education can be used to inspire students to study science and engineering in high school and at the tertiary level.

Visiting the Andoya High School in Norway was particularly rewarding, as the aerospace elective was an excellent working example of everything this project was designed to study and represents much of what I would like to implement in Australia for Australian students. Westchester High School, Los Angeles, was another most rewarding experience. Different in its approach from Andoya, the opportunity for students to study an additional two years of mathematics and science beyond that which is usually required, prepares these students extremely well for acceptance into and success in engineering type courses at University. Northeast Magnet School in Wichita offers Project Lead the Way, which is designed to introduce school students to engineering.

The International Space Development Conference in Los Angeles was extremely useful, as the Education track revealed many space education resources for teachers.

Lessons, Conclusions and Implementation:

There are solutions to the general problem of declining enrolments in science and engineering courses. These involve inspired teachers and innovative programs which exceed the minimum curriculum requirement. Student's fascination with space can be harnessed effectively to engage and motivate. Many successful models are operating in overseas schools, and many space education resources are available to teachers worldwide.

Teachers need to be able to network with colleagues overseas to share ideas and remain aware of new resources becoming available. To this end, in my capacity as Education Committee Chair of the National Space Society (NSS) I will undertake to establish a teacher's section on the NSS website. This will list url's for resources such as PONGSAT, and others I found on my trip. I will discuss with the NSS Senior Vice President the possibility of including a teacher's noticeboard, where Australian and overseas teachers can exchange information. In my capacity as the Australian Coordinator for World Spaceweek, I will make this information available to relevant teacher organisations.

Many innovative programmes are devised and taught by a singular inspired individual. Such programs can be at risk if the said individual leaves the school, or passes away, as happened in two of the schools I visited. It is essential that these innovative programs be incorporated into the curriculum so that they are not lost if the above-mentioned circumstances arise.

While facilities such as Victorian Space Science Education Centre (VSSEC) exist for use by school students on a large scale, I am also aware through my annual School's Space Technology Symposium, of individual teachers with extracurricular space activity programs. Even so, the capacity and resources do not exist to make this extra dimension available to all Australian school students. To this end, I will undertake to write a year nine and ten elective aerospace course for submission to the NSW Board of Education for endorsement. Ideally I would like to lead a team to develop a year nine and ten aerospace elective suitable for implementation Australia wide, and which would segue students into the senior physics and chemistry courses in their respective states. This would need to be coordinated and supported by the Federal Government.

PROGRAMME

1. Andoya High School, Norway
Contact: Mr Hugo Larsen
2. Friedriks Gymnasium, Germany
Contact: Herr Bernhardt Brauner
3. Thomas Starr King Magnet Middle School, Los Angeles
Contact: Charlene Hirotsu, Principal
4. International Space Development Conference, Los Angeles
5. Westchester high School, Los Angeles
Contact: Mr R. Keating, Magnet School Coordinator
6. Northeast Magnet School, Wichita

MAIN BODY

The aim of the project was to study specialised space, aerospace and engineering curricula in schools in Europe and the USA, with a view to developing similar curricula for use in Australian schools. This is necessary to contribute towards counteracting the decline in the number of students studying science, and engineering at the tertiary level.

Students find space fascinating and inspiring. The incorporation of more “hands on” space activities into the existing Australian curriculum and the development of board endorsed elective subjects in the area of aerospace could encourage more students to study science and engineering at the tertiary level.

ANDOYA HIGH SCHOOL (Andoy Videregaende skole)

The high school in Andoya, Norway offers a specialised aerospace curriculum. The aerospace course is taken by selected students, in addition to regular subjects. Entry to the course is competitive, and attracts students from all over Norway. In addition to coursework, students take field trips to destinations such as the Jet Propulsion Laboratory and study the telemetry section of the course at the Andoya Rocket Range.

Students study satellites with satellite simulation equipment specially built by a university. The model satellites are mounted on mechanical “arms” and students control them using computers. Apart from the prototype, these are the only such items in the world.

The aerospace course was developed and written by Mr Hugo Larsen, who still teaches it. Curriculum changes require re-writes, which are all done by Mr Larsen.

This course is a very successful model, most of the students who graduate from this course enroll in engineering courses at universities. One graduate of this program is studying in Australia.

The Friedrichs Gymnasium in Herford, Westfalia

This school is fortunate to have a working observatory, which is operated and managed by former physics teacher at the school Herr Bernhardt Brauner. Herr Brauner retired in 1997 but still operates the observatory for the public. Herr Brauner, who had an astronomy club at the school, conceived of the idea to construct an observatory. He then set about raising the 30,000DM required to purchase the metal dome from a US company. This amount was provided by a local businessman, who was a former pupil of the school. Other fundraising purchased a 14 inch reflecting telescope and a large camera. The telescope has an equatorial mount and is computerised, with most of the electronics built by Herr Brauner himself.

Although located within the school grounds, the telescope is not part of the school curriculum. Since his retirement, Herr Brauner has attempted to teach current teachers at the school to operate the telescope, but teachers lacked the time required to learn to use something that was not part of the curriculum. The observatory is used by Herr Brauner for astrophotography, and now has a ccd camera. It is also used as part of an international project to observe variable stars.

Thomas Starr King Magnet Middle School, Los Angeles

This school, being a middle school, has students ranging from year 6 to year 8. Year 6 students in the magnet program at this school study an introductory robotics class using equipment such as k'nex. They used to be able to progress to a more advanced level of robotics, under the guidance of Mr Steven Dworetzky. I was fortunate enough to spend a day in Mr Dworetzky's class in 2004. The students were engaged and motivated throughout every lesson. They made extensive use of computers and k'nex to solve problems, work as teams and within a budget, and were linked to various NASA programs via the Internet. As a result of this visit, I have incorporated the use of k'nex into the activities of my Space Club at my own school, and was very much looking forward to renewing my acquaintance with Mr Dworetzky.

Upon arranging my visit in 2006, I was extremely saddened to learn of Mr Dworetzky's untimely death late in 2004. I decided to continue with the visit to Thomas Starr King, as the school has other outstanding programs in operation, such as the animation elective, and I wanted to see if the robotics class had continued. Unfortunately the school had been unable to find a teacher of Mr Dworetzky's calibre to continue the course. His room with his equipment inside, remains closed. It is my hope that a suitable candidate can be found, as I feel that the continuation of his program would be a fitting memorial to a truly outstanding teacher.

Thomas Starr King has an animation elective class taught By Mr Kirk Palayan. In this class also the students are "switched on" to learning. Mr Palayan uses an animation package called Maya. I feel that animation would be a useful tool in an aerospace elective and add another dimension to the learning of the subject. Thomas Starr King makes excellent use of short filmmaking in general. English classes make small movies about poems, which gives the students another perspective from which to learn the subject. From my observations of this school, I must conclude that student attending are most fortunate to have innovative, creative teachers with thorough understanding of their subjects.

CONFERENCE: International Space Development Conference, Los Angeles, Ca

I attended this conference as a presenter and Chair of the Education Track. The education track presentations yielded some excellent resources which Australian teachers and students could take advantage of. These are:

- *PONGSAT* Students place a small experiment inside a ping pong ball. This is then sent to the PONGSAT team and launched to the edge of space on a weather balloon. After the flight the ball is returned to the student along with photos and a data sheet for analysis. There is no cost apart from shipping.
- *Teacher in Space*. The Space Frontiers Foundation developed this project to launch teachers to the edge of space. Whether non-US citizens can have access to this program is not clear at the moment. I feel the Australian Government needs to address this, perhaps in the form of financial contribution to this company so Australian teachers can take advantage of this program. It is always more inspiring for students if someone can speak to them from personal experience.
- *Space Generation Congress* A space forum for young people

WESTCHESTER HIGH SCHOOL, Los Angeles

This school used to be an aerospace magnet school, but with the closure of large aerospace companies in the local area, now concentrates on high level science and mathematics in its Magnet program. Normally, students are required to study two years each of science and mathematics. Westchester requires that they study four years of each. The school offers advanced placement course in some subjects. This means students in advanced placement courses study at first year college level, so they can enter college with credit in some subjects. This is a good way of accelerating gifted students, while socially keeping them with their peer group.

The higher level science and mathematics courses offered at Westchester would facilitate those student who wish to study science, mathematics and engineering at University entering their desired courses. Unfortunately, as is the case in Australia, privacy laws prevent schools from accessing information about how many of their students study such subjects at the tertiary level. This prevents, to a large degree, a school from ascertaining the success of their programs. Conversation with Mr Ron Keating, Magnet School Coordinator at Westchester revealed that any information about the college courses a student takes is usually passed on informally by siblings still at the school, or when former students visit to chat with favourite teachers.

Westchester offers students a stimulating environment, many educational opportunities, and dedicated teachers who care about their students. I observed the physics teacher, Mr Thomas Kill devise a practical activity from everyday items. The students benefit from this as in addition to learning physics, they learn to use initiative.

Northeast Magnet School, Wichita

This school has an engineering magnet program. Computer modelling is used extensively, and the school is involved in Project Lead the Way, which is a curriculum designed to inspire students to study engineering. This lends itself

perfectly to the purpose of this study tour. The course consists of a series of engineering subjects designed to fit in with traditional mathematics and science subjects. It demonstrates in a practical manner how these subjects are used by engineers, to solve problems. There is support provided for school involved, including teacher training. There are courses suitable for both US middle and High school, which corresponds to all of the age groups in Australian high schools, as we do not split the students.

Project Lead the Way website: <http://www.pltw.org/aindex.htm>

CONCLUSIONS

1. All of the schools I visited make an extensive use of computers in all classrooms, not just IT based subjects.
2. Programs seem to work best when they are incorporated in to the curriculum, rather than used as extra curricular activities. Some of the most innovative and successful programs I observed, such as the Norwegian Aerospace elective and Mr Steven Dworetzky's Robotics course, were initiated by and taught by one individual. It is vitally important that the skills developed by these individuals are passed on to other teachers.
3. Inspired teachers inspire students. More thought should be given to showing teachers how to make learning more "hands on". Activities related to space can be incorporated into other aspects of the NSW science curriculum in a relevant manner.
4. Australian teachers need access to overseas programs such as the Teacher in Space program mentioned earlier
5. Linkages need to be forged between schools and higher education and other research institutions.
6. The Australian Government needs to be made aware of the long term effects of an unchecked downturn in the number of students studying science, mathematics and engineering, and following these through to a career. It needs to act now to ensure that science is presented to students in an engaging manner. Young people's fascination with space is a perfect tool with which to inspire. I have observed first-hand many excellent programs in action both in Europe and the US, which facilitate this. Australia needs to tap into these programs, or develop some of our own.
7. Australian teachers need to be made aware of programs and resources available. Information about these needs to be made available to the Science Teacher's Associations in Australia, organisations such as the Department of Education and Association of Independent Schools. It needs to be accessible on websites used by teachers, and, as time passes, will need to be updated.

RECOMMENDATIONS

- In my capacity as Education Committee Chair for the National Space Society (NSS), I propose to add a teacher's section to the NSS website. This will list url's for resources such as PONGSAT, and others I found on my trip. I will discuss with the NSS Senior Vice President the possibility of including a teacher's noticeboard, where Australian teachers can exchange information with each other and their overseas colleagues.
- This report will be disseminated to all relevant persons and organisations as discussed in the conclusions. If the Winston Churchill Memorial Trust concurs I will disseminate this report to my own extensive network of teachers.
- I will make a separate report to my employer, the Sydney Anglican Schools Corporation (SASC) regarding education initiatives the SASC might undertake.
- I will undertake to write an Aerospace elective curriculum for submission to the Department of Education for endorsement.
- In accordance with conclusion 5, the Australian Government should establish a liaison officer who can proactively oversee the creation and maintenance of linkages between schools and research organisations.
- The Australian Government needs to make funds available for selected Australian teachers to access international programs.
- The Australian Government needs to make funds available to increase the number of computers available in schools.
- The Australian Government needs to assume responsibility for seeking out and liaising with interesting and innovative education programs both domestic and international, such as the Norwegian Aerospace elective, Project Lead the way and PONGSAT.