

## AN INTERNSHIP AMONGST MILLIONS OF POINTS

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### Commission VI

**KEY WORDS:** Internship, Science Transfer, Terrapoint Canada Inc. LiDAR, Photogrammetry, Operation, Processing

#### ABSTRACT:

During the Geomatics Engineering Course at the Federal Institute of Technology in Zurich, Switzerland, the students undertake a compulsory internship. This practical work takes place outside the Institute. The main locations for practical work are the following: engineering and planning offices, industrial and geodetic companies. This internship typically takes place during the seventh of ten terms and is required to be a minimum of four months duration. The objectives of this internship are to strengthen the practical know how and also enables the geomatics engineering students to become familiar with the professional handling of geomatic questions. The work experience is intended to promote an understanding of the general political, and economic constraints under which geomatic solutions can be developed and implemented. This is an important step to translate the knowledge into actions beyond that which was acquired during the three previous years at the university.

The ability to combine knowledge from different courses to solve a certain problem is a challenge as well as a training to develop work oriented solutions. Additionally to that, work conditions are influenced by a tight processing and delivery schedule and bring a new aspect into student's work habits.

#### ZUSAMMENFASSUNG:

Der Studiengang Geomatikingenieurwissenschaften an der Eidgenoessischen Technischen Hochschule in Zuerich, Schweiz beinhaltet ein obligatorisches Praktikumssemester. Dieses Praktikum wird waehrend mindestens vier Monaten ausserhalb des Institutes absolviert. Ueblicherweise wird es von den Studenten waehrend dem siebenten von zehn Semestern geplant. Die wichtigsten Arbeitgeber sind in den Bereichen der Ingenieur- und Planungsbueros, Industrie, sowie geodaetischen Privatfirmen zu finden. Schwerpunkte liegen im praktischen Arbeiten sowie beim Erlernen von professionellen und wirtschaftlichen Arbeitsvorgehen. Die Absicht ist, dass die Studenten einen Anhaltspunkt in geodaetischen und oekonomischen Anwendungen ihres zukuenftigen Berufes erhalten. Dies ist wichtig, um das waehrend den vergangenen drei Jahren erlernte Wissen an der Hochschule in Tat umzusetzen. Wissen aus verschiedenen Disziplinen muss kombiniert und zu einer einheitlichen Loesung zusammengefuehrt werden. Dies bringt einige Herausforderungen mit sich, die die Arbeitsweise des Studenten nachhaltig veraendern. Dieses Manuskript soll einen Einblick in die grossen Vorteile aber auch Nachteile eines solchen Praktikums geben.

## 1. INTRODUCTION

An internship in the private industry and especially with a company located abroad presents different challenges and experiences. Before the internship can be started an extra expenditure has to be managed by the employer as well as the student. Typical issues such as the work permit as well as a requirement to obtain a social insurance number. Once these issues have been solved, new challenges take place for both parties. On one hand there is the language barrier as well as a different working mentality. These challenges provide experiences which cannot be gained at the university level.

This paper will not only focus on the challenges and experiences from an intern's point of view but also from that of the employer. Moreover, the genuine benefits and advantages of an internship will be highlighted and potential pitfalls will be investigated. Finally, conclusions will be drawn as to whether internships are worth the extra time and commitment from all view points.

## 2. ORGANIZING AN INTERNSHIP

### 2.1 Find an Internship Placement

The chair of education at the ETH Zurich makes students sensitive to the future internship in advance. The search requirement and responsibilities to find a placement for the work term are up to the student. Students are absolutely free in finding a work place as long as it is related to geomatics engineering. Thus, the work field and the company can be chosen according to student's interests.

This particular internship comes up with some additional challenges. The negotiation with the prospective employer takes longer than for domestic jobs. Main reason might be the employer who is not familiar with the foreign education system and due to that the student's skills. Experiences have shown that the current international equalization of university education and degrees are helpful concerning comparisons and assessment. But considering degrees and a comparison of student's courses is not sufficient to allow final decisions and conclusions. That means, the prospective employer is left in the dark about the full skills of a student. The same issue appears also for the student who is not familiar with the foreign education system and thus may be left in the dark about what the employer might expect concerning skills and knowledge. Moreover, both sites have to be aware that a language barrier might be a problem during work term.

## 2.2 Place of the Internship

This particular internship takes place abroad at Terrapoint Canada Inc. in Ottawa. Terrapoint is well known in the LiDAR business. It has over 50 employees, offices in Houston, Calgary, and Ottawa. The employees have a different background in Engineering, Physics, Surveying, and Geodetics. It has provided more than 500 LiDAR projects and other digital mapping services for a diverse clientele for the past twenty years. During that period, Terrapoint has become the largest, most experienced LiDAR survey company in the world. The seven LiDAR systems - four in a high and three in a low range modus - have been operating in over 40 countries around the world.

The main idea of this internship is to see and become familiar with a LiDAR and photogrammetry project. To go through an entire work flow; starting from the onset until data is ready to be delivered to the client. The work flow of such a project requires contributions from many fields of work. It encompasses the project planning, data acquisition, processing, quality procedures, and the opportunity to export a high-quality product as a derivative of the laser point cloud.

Moreover, the work with LiDAR projects assume an understanding of correlations between different disciplines. On the one hand there is a talent of organizing a project in different areas, on the other hand the technical, and engineering part of planning and processing.

## 3. OCCUPATION DURING WORK

### 3.1 LiDAR Project

The first weeks of the internship encompass a training in several fields of work at Terrapoint. That gives a gross overview of what the company is doing and with the kinds of data that will be used in the next few months. The next step is an introduction to an entire LiDAR project. The co-operation from employees who have long term experiences in a relatively new business provides an outline of the difficulties and tricks of managing LiDAR projects. A data acquisition tour was taken during the initial two weeks. Once the project planning is done, the mobilization of the required equipment has to be organized. LiDAR as a airborne based system brings special safety procedures and requires a lot of preparations. Part of the training was attending the mounting of the LiDAR system and learning how its three main gauges, namely GPS, IMU and the Laser work together.

Before anything can be launched on the project site, ground work is required. First of all a GPS network is established which ensures that the planned accuracies can be ensured. Furthermore, a so called ground truthing is established which will be used as a quality control during the processing of the LiDAR data. The intern acts as system operator during several missions on the helicopter.

After a coarse field processing and an initial quality check, data goes into a further step of the project. The office processing is responsible to bring the raw point cloud to a high-end product. This process comes up with new challenges for the intern. A couple of new software packages have to be learned. Generally, the processing of a LiDAR project can be standardized but every project comes up with different challenges. On the one hand new issues with the LiDAR system are figured out, on the other hand a processing work flow is always in a progress of improvement, software packages get more powerful, and computer are getting faster, etc. Generally, it might be the first time where an intern has to work as reliably as never before. Mistakes or problems cause directly data quality compromises and hence threaten the financial break even of a project. LiDAR missions require a proper

work skills and practices during data acquisition to derive a high quality point cloud. If problems appear during a mission, issues will appear at least at one of the further processing steps.

### 3.2 Photogrammetry Project

Terrapoint provides its clientele with LiDAR data as well as imagery. Therefore the second half of the internship is focused on Terrapoint's photogrammetry projects. The internship is responsible for several tasks concerning photogrammetry and works alone at the beginning. To get familiar with Terrapoint's former photogrammetry projects a catalog is developed which will show the prospective clients what is possible with imagery and what might cause difficulties. The benefits and the disadvantages of photos are outlined so that every client gets an idea. The results are given in general processing steps of a photogrammetry project as well as specific targets of the company itself.

During current imagery projects, the intern is interacting with other companies which are co-operating to achieve a successful project. This brings a new aspect into student's work. A precise description of problems and targets challenges the intern. Solutions have to be checked on both sites. Questions like: Is the new solution executable and might it bring new benefits into the current work flow, have to be investigated. Furthermore, a documentation for the selected mosaicking process is written by the intern. Thus, after a few weeks the intern is integrated into a small group of prospective photo processors. The co-operation encounters a training and on-the-project training.

During the internship Terrapoint has enlarged its capability to process photo projects. This brings new tasks into the processing work flow. A totally new concept of data handling, data management and especially data backing up have to be discussed. A concept is never considered perfect until enough experience with projects can be gathered. This assumes that the processing group plans and calculates scenarios for the near future to be reliable and faster. This planning turns out to be very important because it takes effect at the very beginning of a project. At the beginning when sales people go to the clients and negotiate the proposal which directly constrain the time of processing.

## 4. OVERALL EXPERIENCES

### 4.1 Disadvantages and Difficulties

An internship in a foreign country has previously un-encountered working conditions. Initially, long discussions and uncertainties about getting a job and the required work permits face the intern. Moreover, the working term in a foreign cultural environment is very intense. Everything is conducted in English. A lot of English pertaining to the work environment is already known from studies at the university which publishes scripts in English and this, allows the students to become familiar with the technical expressions. At the beginning, one of the main issues for the intern is to follow the well defined procedures and benefits from the knowledge and experience of the colleagues. After a good introduction, several links can be done just after a couple of weeks.

### 4.2 Benefits and Positive Experiences

Generally, an internship changes a student's mind concerning work practices. On one hand the work has to be done in a tight schedule and has to be reliable. Mistakes usually appear sooner or later in a further on in the project process, so the work has not only to be done with great concentration; the student has to be figure out how one's work can be controlled and checked. Control

procedures might already exist in the standard processing work flow but there are still a few opportunities to do checks on your own. This controlling process can really good be linked with the methods and techniques learned at university. The university has several approaches to train the students in controlling and to become familiar with a quality oriented work environment.

An internship might be also the first time where different disciplines have to be linked and used together. Rarely are problems tied only to one field of work. Approaches for solving a problem have to be seen from different point of views as well as weighing up solutions against each other.

Another well known syndrome during exercises at the university are the projects. Usually, small projects are shared at university to train students in a particular task. This may change when working at a private company. Projects can have huge amounts concerning of data and require a much longer length of time than project assignments at the university. Therefore, problems like data management appear sooner or later once the student gets in contact with photogrammetry projects. The huge amount of data requires a very time consuming process which has to be optimized for efficient work.

An independent work experience and the exchange with people of different background in science and life experience make an internship interesting. One is faced with an environment where all of the employees have varying levels of experience and variety of different background knowledge.

Geomatics engineering is no longer a separate discipline. A successful company must have a good background of computer science. Almost all geomatic applications are based on computers and electronic tools. A good knowledge in related science makes life as geomatics engineer easier.

It is beneficial to work at least once in a foreign country to see and watch how geodetic problems are handled. For example the surveying sector in North America. It still requires a high attention concerning measurement units. Canada decided 1970 to change to the metric system. Though this is not necessarily by choice but may instead be due to the overwhelming influence of the neighboring and largely non-metricated United States that older generations are still thinking in different units. Personal experiences showed that - for coming from a metric system - more attention and imagination are required. That is especially the case for U.S. based projects where still the non-metric system is in use. Conversions and a neat and correct reporting of customary units is inevitable. Different countries have different geodetic systems. A work term encompasses experiences with different geodetic systems. For example North America are projections such as UTM and the specific State Plane are in use and these are very rarely be seen in Europe.

Another observation is have been made, that the surveying sector in Canada has a high degree of safety awareness and due to that high standards in health and security programs. Safety procedures are well defined and have to be studied by everybody who is working in the field.

After a while the challenge of a different language during an internship turns out to be an advantage. Technical problems and solutions have to be formulated in a much more compact and precise form, and reduced to the essential content. Especially writing project documentation is not encountered are an unknown field of work during study terms. Many questions and challenges occur when learning to use software tools since read and interpreting manuals typically is different in another language and many items and expressions have to be figured out.

**4.21 Bottom Line** An internship in the private industry can help to develop personal strategies concerning management. A graduate geomatics engineer is sooner or later confronted with the management of different resources within their company. The

range of such tasks is wide and can encompass working out of technical solutions, contracting, client support, data management, human resources, etc. Working with graduate engineers give an idea of leadership issues and how to conduct a group of employees. Moreover, Terrapoint is an international operating firm which is running three branches in three different places and two different countries. This introduces new new challenges and solutions for an internal communication system and for a good work atmosphere. Sometimes team work is required with people who have never been seen before and the primary communication medium is the telephone.

## 5. CONCLUSIONS AND RECOMMENDATIONS

Once the decision to find an internship in a different country is made, a long time of uncertainty and discussions with different people and organizations is part of that process. Usually, several weeks pass until a company indicates an interest to hire an intern. One of the most important point to find a place for the internship is an open-minded attitude to consider each job offer. After the work placement has been selected several points have to be considered. Experiences show that the search and especially the bureaucracy to get a work permit can be very time consuming. It is recommended to search several months in advance. Nevertheless, the extra expenditure is it worthwhile and the benefits of the work experiences are huge.

Furthermore, connections to people of different sectors of geomatics engineering may help in a later work place to succeed.

## 6. ACKNOWLEDGEMENTS

The author would like to thank Roger Shreenan, Vice President Operations, Terrapoint Canada Inc. for his deployment and his time for answering patiently the many questions. Moreover, a great thank to all employees of Terrapoint for their co-operation and patience during the internship between October 16, 2005 and March 31, 2006. Also a great thank goes to Emmanuel Baltsavias - responsible person for the intern at the Swiss Federal Institute of Technology in Zurich - for his support during the internship.