APEGM Progress Report for: #33485 - Bernard Adu-Quaye

Period beginning: **Sep 6, 2011** and ending: **May 7, 2012. (8 months)**

Submission Date: Jun 10, [illegible]
Supervisor: [illegible] Submitted on Sep 26, 2012
Period Employer: Manitoba Hydro
Job Title: Engineer-in-Training

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1. Give a description of the Engineering work experience you have obtained during this reporting period. Include information supporting the rest of your answers.

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Overview of my work experience during this period:
During the period under review I worked in the Communications department, I planned and designed installations of fiber optic cables, including fiber termination panels,and as stated in my last report, installing these equipment facilitate the transmission of voice, data, and video. The installation of fibre optic cables and the termination panels in Manitoba Hydro's communications facilities are essentially for controlling and monitoring of generating stations' and substations' equipment. They are also for local area network (LAN) and wide area network (WAN).I was involved with the evaluation and assessment of Valdor Connectors,which are for connecting fiber strands. I also conducted a research to identify standard procedures for conducting acceptance test on fiber optic cables by reviewing various tests required to determine the quality and the specifications of fibre optic cables. In this report, I have also briefly revisited the moisture detector test experiment and what was done during the period under review. Within this reporting period, I also attended a seminar which educated participants on the best approaches for multicultural relationship at the Canadian workplace.

My responsibilities included but not limited to the following:
•Prepare work packages for installation of fibre optics cables and their associated equipment.
•Conduct research to identify the standards for fibre optics cables.
•Conducts site visits to Manitoba Hydro's communications facilities for surveys.
•Prepare survey drawings to be converted into AutoCAD drawing.
•Attend vendor meetings for the promotion of telecom products.
•Develope test procedures for conducting acceptance test to verify the specification of telecom products.
•To ensure that projects are implemented timely and within budget.
•Monitor risks associated with projects and develop mitigation strategies if needed.

During this reporting period I was involved with about four(4) projects, which includes the following:

Project #1-MTS ALLSTREAM FIBRE SWAP
This project was initiated by an agreement negotiated between MTS Allsream and Manitoba Hydro whereby Manitoba Hydro will have access to two fibre strands in MTS's fibre optic cable which runs through the western part of Manitoba, and under the agreement, MTS will also have access to two fibre

strands from Manitoba Hydro's fibre optic cable which runs through the eastern part of Manitoba. The part of the project assigned to me and a colleague involves the provision of building entrances and mounting of plywood to accommodate MTS's termination panels at the following substations: Neepawa Radio building, Dauphin-Vermilion Station, Minitonas Station, Overflowing River Station, The Pas Service Centre and Cliff Lake station.

Application of Theory

The communications rooms in which the termination panels are to be mounted are located within or close to substations and our duties involve conducting a cable route survey to determine how far from the stations the MTS's manholes must be positioned. The positioning of the manholes is determined by the ground potential rise (GPR) of each substation.To preserve electrical isolation from the substation, the MTS's cable had to be transitioned to all-dielectric cable.These manholes are for the splicing and storage of some cable slags. We conducted surveys to determine the cable routes from the manholes to the communications building. Part of our duty also involved determining the suitable route for running conduits within the buildings and suitable locations to mount the MTS's termination panels.

To ensure that all the existing infrastructures within the sites are identified and secured from any damage which could arise during trenchings and directional drillings, a staking was done to determine the locations of all existing underground infrastructures within the construction area.This was also facilitated by investigations on the eGIS (Manitoba Hydro's internal software for investigating plant locations) to confirm the existing underground facilities within the sites.

Based on the outcome of our field surveys, drawings and work package were prepared which will guide those who will be doing the works. A bill of material was also included in the work package.

To provide a better understanding of the internal works, which was undertaken by Manitoba Hydro's Electrical Construction department, we organized a joint site visit with the Electrical construction team to all the affected sites prior to handing over the works to them for implementation.Manitoba Hydro's underground crew who will implement the underground part of the work were also briefed on their role, and were provided with guidelines.

Project # 2- INSTALLATIONS OF FIBRE OPTIC CABLES AND FIBER TERMINATION PANELS IN THE COMMUNICATIONS AND COMPUTER ROOMS AT 820 TAYLOR AND 453 DOVERCOURT

Overview of the Project

The Systems Support Department of Manitoba hydro requested for additional circuits between 820 Taylor and 453 Dovercourt-Manitoba Hydro's facilities.The Fibre design group was tasked to provide these circuits. I was tasked to prepare a work package for the installation of the fibre optic cables and the fibre termination panels involved. Manitoba Hydro's Electrical Construction Department was responsible for the installation of the fibre optic cables and the termination panels, whilst the communications department handled the splicing and terminations of the fibre optic cable. The commissioning tests were also done by the communications department.

This project involved the preparation of drawings and work package for the installation of termination panels and two (2) AIA tight-buffered 48 Single-mode fibre cables. The project also included the splicing and termination of the two Aluminum interlock amour (AIA) tight-buffered 48 Single-mode fibre cables in the Communications and the SCADA rooms at Manitoba Hydro's 820 Taylor Avenue and the 453 Dovercourt Communications facilities.

Part of the work also involved the Installation of a fiber patch cords storage unit ADC-FL2-H2STORE and a fiber termination panel ADC-FL2-48RPNL in Cubicle BCNET1 in the computer room. Another fibre patch cord storage unit ADC-FL2-H2STORE and a fiber termination panel ADC-FL2-48RPNL were installed in Cubicle BCNET2 in the computer room.

Second phase of the equipment installation involved the installation of a fiber termination panel ADC-FL2-48TS875 in rack 10.12 and in rack 21.4, all located in the Communications room. The third phase of the work involved the installation of the two (2) AIA tight-buffered 48 Single-mode fibre cables which were to link the cubicles in the computer room.

The forth phase of the installation involved the splicing and termination of the AIA tight-buffered 48 SMF cable at the ADC-FL2-48TS875 in rack 10.12 and rack 21.4 in the communications room. The cables were preterminated at the BCNET 1 and BCNET2 ends.

Application of Theory

•I conducted a site survey to identify the suitable locations for the equipment to be installed. I closely and carefully examined the cubicles and the racks where the equipment were to be installed to identify the rack units available and checked if the available spaces were adequate to accommondate the termination panels.

•I conducted a site survey to identify the suitable route for the cables and checked all the available routes and selected the most suitable route which will ensure minimum cable length for the connection between the computer room and the communications room. The computer room is located on to top of communications room hence the cable was routed through the ceiling so as to minimize the cable bends.

•I took measurements to determine the cable lengths. An extra length for contingency of about 10 percent was added to the measured length, this will enable some cable slag for coiling along the cable route. The cable slag is intended for storage in event of moves add and future changes in the unit's position.

•I checked in equipment's catalogue to select suitable termination panels and storage units for the project. The termination panels were selected based on the fiber counts of the cable.Since the cable was 48 single mode fibre, a 48- ports termination panels were selected with the termination panels located in the computer room having only ports for plug-ins whilst the panels located in the communications room having splice trays for splice storage and ports for plug-in of the pig tails.

•I referred to a cable catalogue to identify the suitable cable for the project. The installation of a cable inside any building must meet the Standards of the Canadian Standard Association (CSA) and the building code requirements. The selected cable-Aluminium Interlock Armour (AIA) 48 single mode fibre optic cable is FT4 rated and as such can withstand flame since the cable was not run in a conduit.

•I prepared a bill of quantity for the successful implementation of the project, some of the items included the earthling clamps for grounding the cable armour for protecting personnel working on the termination panels.

•Utilizing the Engineering drawing management system (EDMS), I searched for all drawings related to the project and designed new drawings which integrated the proposed installations with the existing drawings.

•I sketched the network architecture for the various installations, showing the positions of the cubicles, racks and the fiber optic cables interconnecting them.

•I prepared the work package in which I outlined the following: Activity Numbers, general work description, the cable type and its parameters, details of the installation, the bill of quantities, drawings and the contacts of the stakeholders of the project.

•I visited the site during the implementation period and had discussions with the installers aimed at reviewing the work package with them to see what could be done better in my future work package preparation for similar projects.

PROJECT # 3 ACCEPTANCE TEST FOR FIBER OPTIC CABLE

Overview

This assignment involves preparing an test procedure for testing a fibre optic cable procured from a Chinese manufacturer.

An optical cable must be tested upon arrival from the manufacturer to confirm that they indeed meet all the specifications stated and is without any defect which could be inherited from the manufacturing process or the shipment.

The following preliminary acceptance tests must be conducted upon receipt from the shipper. They are cable reel test, cable length confirmation test and cable strands continuity test.

Tools Required for the test are as follows:

1.Fiber optic Cable cutter
2.Armor Stripper
3.Kevlar Shears
4.Alcohol and wipes
5.Fibre stripper
6.Fibre Cleaver
7.Bare fibre adapter or jumper end suitable for splicing to the fiber
8.OTDR
9.Heat shrink and cable ties
10.Reel test data sheet

The procedure for testing the cable is:
1.Record the following information
a.Cable ID
b.Cable type
c.Number of fibers
d.Cable length as shown on reel
e.Maximum specified loss at 1550 nm
f.Maximum specified loss at 1310 nm
g.Manufacturing date

2.Inspecting the cable, we record any visible signs of defects, including abnormalities evident on the cable jacket, inconsistencies in cable markings and apparent damage to either the reel or to the cable. Any cladding will have to be removed for this test.
3.Strip a length of the fibre suitable for this test. Clean and strip the fibers.
4.Using a bare fibre adapter and an OTDR, we take the following readings from one end of the cable. We may also splice the fibre to a jumper which in turn could be connected to a test fiber. The test is connected to the OTDR for measurements to be taken as follows:
a.Total loss at 1550 nm
b.Attenuation per kilometer at 1550 nm
c.Total loss at 1310 nm
d.Attenuation per kilometer at 1310 nm
e.Total length as indicated by ODTR (index of refraction must be provided to validate length).
5.Record the OTDR traces. Indicate the direction of measurement, and loose tube and fiber colour.
6.Note the difference between the 1550 nm trace and the 1310 nm
a.Greater attenuation at the lower wavelength should be expected
b.Uncut cable should have no reflections or attenuation steps.
c.Larger attenuation steps at the longer wavelengths may indicate a macro bending.
7.Compare the test results to the manufacture's specifications.
8.Remove the bare fibre adapter and cut off the excess fiber from the cable end.
9.Install heat shrink or other protective covering to the cable to prevent water ingress.
10.Install a cladding on the reel.

Application of Theory
•I researched about the various types of fiber optic cables and their associated specifications. The research also covered the types of cables to install in any particular environment.
•I researched about the various instructment for testing fibre optic cables and the suitable procedures for testing these cables.
•I had discussion with experts in the fibre optic cable testing industry to enquire about their methods for testing cables.
•I reviewed the IEC's recommended tests such as: Compression, Flex, Impact, Strain, Twist, Water Penetration, Bending, jacket self-adhesion, Optical micro bend and Tensile strength which are all

considered mechanical tests. Environmental tests such as cable freeze, drip, heat age, low high bend, temperature cycle and cable jacket shrinkage were also considered.
•I read through the products catalogue for some cable manufacturers to review the various methods they apply in testing cables and the industry values they have for those standards.

PROJECT #4 Test of moisture Detectors
As already explained in my previous report, this project involves conducting a test on moisture detectors to determine their ability to timely respond (indicate attenuations on the OTDR) when they come into contact with water. The communications department deploys these moisture detectors in the splice trays, when fibre optics cables are installed, to check water ingress or excessive humid conditions in the splice trays. When water enters the splice trays and comes into contact with the moisture detector or the humidity increases excessively this triggers the moisture detectors and a signal in the form of attenuation is registered on a remote fibre test station (RFTS) which indicates a particular value of attenuation and enables personnel to attend to check the splice tray in question.
As reported in my last report, the cable for the experiment was taken away for another work hence the experiment was not completed.
During this reporting period, a cable was made available and so we were able to set up the test stand. The test stand consisted of the following: 3 km cable drum, a remote fibre test station, an humidity sensor and fibre optic splice closure.
One end of the cable was spliced to connectors which were in turn connected to the RFTS/OTDR. Splicing was done and the two types of the moisture detectors to be tested were inserted in the splice enclosure. A sensor, for monitoring the relative humidity in the splice enclosure was inserted to sense the relative humidity inside was connected to a unit which registers and records the humidity readings. The humidity inside the enclosure was generated by placing a damp cloth inside the enclosure; this procedure tends to introduce an instant rise in the relative humidity which was not our pefered choice for raising the relative humidity. Eventually, to have the moisture detectors triggered we did put water directly on them.
Our findings indicated that the old moisture detectors respond faster (as shown by the attenuations on the RFTS) to water than the new moisture detectors.

Application of Theory
•I researched about the various means of introducing humidity in an enclosure and the instruments for reading them.
•I researched about splice enclosures and their different applications and worked together and had discussions with the Technicians to have the splicing done for the moisture detector to be inserted.
•I had discussions with the maintenance team to arrange for a cable for the test.
•I arrange to have an IP address allocated to the system for reading the relative humidity; this is to enable the readings to be accessed from a remote location.
•I consulted with my teammate to consider all the outstanding issues which must be address in order to have a successful experiment.

Practical Experience
•I visited the Manitoba Hydro's 820 Taylor communications and computer rooms to measure the rack spaces available for the installation of the fibre termination panels to ensure that they are adequate to accommodate the panels. During these visits I understudied the existing network and how best to introduce the propose into them
•I consulted with my colleagues and referred CSA standards to help me in determining the suitable fibre optic cable which will be appropriate for the surrounding environment of the equipment of the project.
•I met with a team from Manitoba hydro's Electrical Construction group to discuss the timelines and the details of the installation of the equipment. This meeting provided me the opportunity to considered all aspect of the installation and to address issues which were not considered during the planning.
•I paid a regular visit to the site during the installation of the equipment and had discussions with the

installers to review the work package and identify all the issues that were overlooked during the planning and how to address those concerns in my future planning of similar projects.
•During my site visits I observed the on-going termination and the splicing work on the fibre optic cable and this provided me with the opportunity to see at first hand the quality of the splicing and the attenuations they present.
•I assembled the termination panels by fixing the parts together to make them ready for installation, this work provided me with opportunity to see parts that constitute the panel.
•Based on discussions with the construction team, evaluation of the site conditions, and the understudy of the cable route I was able to determine the approximate length of the cables which will help in the planning for future projects within the same location.
•Constantly coordinated with stakeholders to define suitable positions to mount the termination panels, types and sizes of fiber optic cables to be used for the project.
•I familiarized myself with the procedures for installing equipment within Manitoba Hydro stations.
•I prepared work packages and went through the process for issuance of a work package for construction.
•I attended meetings to discuss progress of the project and to resolve outstanding issues relating to the project.
•I prepared preliminary drawings using AutoCAD which assisted the installation team to proceed with their work whilst the detailed Engineering and the work package are being prepared.
•I organized meetings to discuss with stakeholders critical issues which require prompt attention for the projects to be completed successfully.
•Based on my conducted survey, I determined the future forecast for and selected the appropriate fiber optic cable required for the project that will be adequate for the present and future needs of the Station.
•I read through generic requirement documents for laying premises fiber optic cable to select the suitable cable and conduit pipes for the project.
•I evaluated the volume of work required and scheduled the lead time for the project.

Engineering and Project Management
These projects offered me the opportunity to understudy the structures and the network architecture in the communications and the computer rooms of Manitoba Hydro's facilities. The Communication room at 820 Taylor is an important node in Manitoba hydro's communications network and serves as an important route to some Manitoba hydro's key facilities such as 360 Portage and 453 Dovercourt. These two facilities require high capacity due to the high number of communications equipment located in these facilities. During the project, I had to consider and be careful with all the other cables installed and I did ensure that services on these cables were not interrupted or adversely affected by the new project. The cable route was carefully selected since the bending radius for fiber optic cables is critical to their efficient performance hence the selection of the cable route was based on the various bending and the route with minimum bends was selected. Since the cable was not installed in a conduit, the selected cable must withstand flame; therefore FT4-rated cable was selected. Measurement of the cable length was determined by considering the minimum distances between the two terminals.
The termination panels were selected based the number of fiber strands. There were 48 strands in the fiber cable and so ADC-FL2-48RPNL and ADC-FL2-48TS875 with 48 ports were selected. The panel ADC-FL2-48TS875 has been designed to enable easy splicing and termination of the cable. With its in-built splice trays, the spliced pigtails are stored within the lower part of the panel and this arrangement secures the splices from any disturbance.
The communications and the computer room at 820 Taylor has a grounding bar to which both ends of the metallic part of the AIA-cable sheath were bounded. The bonding of the cable sheath diverts faults currents to the ground, and this helps to protect the equipment and personnel working on the fiber termination panels.
This project provided me with some Canadian experience in Project management and during my collaboration with personnel from other departments such as the Electrical Construction department I

had an insight into a lot of ideas which provided me with an understanding of the processes involve during implementation of projects in Canada.
I was introduced to different approaches to the implementation processes and it was a great experience to work with other colleagues. Manitoba Hydro does most of the works within the corporation's in-house which is quite different from what pertains in Vodafone-Ghana, where most of works are mostly done by outside contractors.
Knowledge about the various standards applicable to fibre optic cables and their associated equipment are very relevant to any fiber optics cable designer and the research on the standards offered that opportunity which will come handy in my daily handling of projects in the department.

Supervisor Agrees: Agreed - this is a pretty thorough capture of the work that Bernard had responsibility for during this period.

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2. Please check the following options that apply:

2.1: During this reporting period, I have applied theory in:

- ✓ Analysis/Interpretation
- ✓ Project Design/Synthesis
- ✓ Testing/Verification
- ✓ Implementation

Supervisor Agrees: As captured in Bernard's overview, Bernard has been involved from original Analysis through project implementation on at least a couple of fronts during this reporting period.

2.2: I have obtained experience by:

- ✓ Studying or being exposed to existing Engineering works
- ✓ Applying Designs as part of larger systems
- ✓ Experiencing the limitations of Engineering designs
- ✓ Experiencing time as a factor in the Engineering process

Supervisor Agrees: The exposure that Bernard has had in the project work undertaken for Fibre Design during this reporting period has provided him with at least some experience in all areas listed here.

2.3: I was exposed to the following areas of Engineering management:

- ✓ Planning
- ✓ Scheduling
- ✓ Budgeting
- Supervision
- ✓ Project Management
- ✓ Risk Assessment

Supervisor Agrees: Bernard had exposure to all elements except his supervision of other employees. He's been involved in budgeting, planning for activity, scheduling with internal and external resource, managing the touchpoints with other groups impacted by the schedule etc.

2.4: I was required to make decisions based on professional and ethical responsibilities to:

- ✓ The Public
- ✓ The Profession
- ✓ The Client and/or Employer
- ✓ Co-Workers
- ✓ The Environment

Supervisor Agrees: Bernard mentioned GPR issues which involve protection of public and other utilities operating in proximity to Hydro Stations. Along with that comes the considerations for customer/employer and co-workers as part of the effort in completing the project work here. Environmental impacts are always a consideration both during consturction and throughout the lifetime

of the project.

3. Describe any activities that have improved your Communication, Teamwork, or Interpersonal Skills in the following areas:

Oral Presentations:
I talk with my colleagues, my supervisor and clients both on the phone and personally. I took part in discussions during meetings.I attended seminars where I actively contributed orally in discussions. I took part in discussions during coffee breaks and during walkings which guys in my office often do during lunch breaks, we do discuss current affairs.

Written Documents:
I write work packages and emails.I write reports on my researchs.I write progress reports for my qualifications to the professional Engineer status in APEGM.

Interaction with Others:
I do interacts with my colleagues and my supervisor.During the peroid under review I was involved with projects which requires constant interaction with my supervisor, my colleagues and clients.I do interact with colleagues from other departments as well.

Other:

Supervisor Agrees: Bernard has had opportunity while working with us during this past period to interface with other professionals inside and external to the organization in order to successfully coordinate and complete the tasks assigned to him. As he's indicated, we've required reports, and written documentation to accompany the work package detail that he's been involved with. Bernard has demonstrated his ability to communicate technical information to others in both written and oral form.

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4. During this period, I had to consider the social implications of my work in the following areas:

My works contributed socially by way of ensuring that power supply is reliable. The installed fiber optic cables provided communications for monitoring the systems transmitting the power.Reliable Power supply is essential for achieving normal life in our daily household activities and also in our work places,our social lifes will be hampered. Hospitals cannot function normal without reliable power supply hence the projects I was involved with have contributed in some way to society.

Supervisor Agrees: Certainly the point Bernard raises resonates with others working in the utility industry. Reliability of electrical power supply to both commercial as well as private sector customers is an increasingly important target. The communications systems that Bernard has been working with help to improve reliability and operational capacity of the systems through better system visibility to the operator group.

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5. Examples of my ability to work effectively as part of a team, during this period, include:

My work on the moisture detector was successful due to my efficient team working ability.The project for installing the fibre optic cable and termination panel was successfully implemented thanks to my efficient team working spirit. I do understand my role within a project and live up to the expectations from colleagues and supervisor.

Supervisor Agrees: Bernard is a willing team member. He has demonstrated his team mentality in a number of initiatives including the topic mentioned above. He participates willingly with others, presents his point of view for others comments and incorporates the responses and participation of others into the overall solution or recommendation.

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6. Examples of my ability to assume responsibility include:

I am a responsible person.During the projects we do arrange trips to sustations outside Winnipeg.Trips of this nature requires initial planning and every team member must be responsive to his/her role and be proactive to their duties.I do report on time at meetings and company equipment in use are well taken care of.

Supervisor Agrees: Bernard has demonstrated his ability to bear responsibility in the consultation and planning trips mentioned above, but beyond this, to the point where he has a good grasp of his responsibility relative to the project work assigned to him, checks with others appropriately when carrying out his work and refers to pertinent practice, standards and guidelines to carry out his regular work.

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7. I have shown progress since the last report (where applicable) as follows:

Supervisor Agrees: No comments provided by Bernard here. Certainly Bernard has had opportunity to continue to develop skills on both the technical side and in terms of interpersonal skills directly pertinent to the success of his work here. Bernard's previous experience in the same general area of communications installation responsibility positions him well to more quickly adapt to the practices and procedures we are familiar with here at Manitoba Hydro and I've seen development in his understanding here.

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8. I feel myself to be lacking in exposure to, or requiring improvement in, the following areas:

I feel confident in the performance of duties assigned and the various projects I have undertaken have so far exposed me to a lot of experience.My speaking of the Canadian English and understanding my supervisor and colleagues during discussions have improved significantly.My knowledge about the Canadian standards have also improved.

Supervisor Agrees: As an international exchange student, Bernard is working through a number of challenges in adapting to the working culture of North America beyond just consideration of his technical knowledge and application of this to his work. Bernard approaches his work and peers with enthusiasm and competency. His exposure and opportunity to work through technical challenges here help illustrate the background he has obtained in previous education and working experience.

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9. I would like to provide the following additional, relevant information:

Education has no end, and for that reason I will continue to learn new things and improve on my existing knowledge.Manitoba Hydro is a great place to work and I count myself lucky to be part of this great company. I will avail myself for the opportunities available within the company and ensure that I take advantage of every opportunities to learn new things.

Supervisor: [redacted] (First Registered: Dec 21, 1994)

I make the following evaluation and recommendation regarding the progress report for this MIT:

As mentioned in the text above, Bernard has embraced his opportunity to work with Mantioba Hydro's Communications Department with enthusiasm. He is a pleasure to work with and has oppportunity to apply his technical background to the many challenges involved in provisioning Communications Infrastructure for his employer. As his supervisor, I recognize that there are challenges beyond the technical that Bernard is facing in his transition to North American work and life (and beyond to the workplace culture at Manitoba Hydro) and I've appreciated open opportunity to speak with him about how those differences may impact his success as a technical contributor here. I've personaly witnessed development in terms of his technical contributions to the team here at Manitoba Hydro Communications and in terms of working through design and construction related issues with others. I recommend that the additional 8 months being considered here be recognized as engineering work experience.

In my opinion, during this reporting period, (Sep 6, 2011 - May 7, 2012) (8 months), Bernard has completed an equivalent of *8* months full time engineering work experience.

Please show my comments to the MIT.
