

# ANNUAL REPORT TEMPLATE : CHAIRS IN DESIGN ENGINEERING<sup>1</sup>

**Report Due Date: May 1, 2012**

**Please verify your personal information below and make the necessary corrections.**

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Chair in Design Engineering Name: « NSERC- chair in design for aluminum (DFAI) »

File No : 411611 - 08

Contact person, Partner name, J.D. Laprise, CQRDA

G. Dufour, Alcoa Canada Itée

D. Larouche, REGAL Regroupement Aluminium

**Top 3 contributions for the year.**

1.

Defining new, industry sponsored, capstone projects.

2.

Providing aluminum to students in their final year capstone project.

3.

Setting up the aluminum assembly workshop for capstone projects.

## **Best Practices**

Please share one best practice that was implemented to be shared with other CDE Chairholders.

### **1. (Since the last report on May 1st, 2011)**

Despite minor delays on the Chair activities incurred by a four months strike of the support personnel (technicians, secretary, etc...) during the fall semester, it has been possible to implement one best practice in April 2012. Indeed, all capstone project teams are now being asked to fill in a budget template and update it at the end of every semester. This will facilitate the follow-up of project contributors and supporters by team members while providing a standardized format for the Chair to gather financial information required for the annual budget reporting. While it was not deemed possible to make this financial reporting by teams mandatory, the Chair made it a condition to obtain free aluminum for their capstone projects. Students have so far been collaborative.

## **1. Overview**

### a. Chair Structure

Please provide an overview of the participation in and contributions to the CDE action plan of each member of the Chair's team (Chairholder(s), professional staff, company experts, collaborators, post-doctoral fellows, students, etc.).

Senior Chair : Prof. Alain Desrochers, P. eng., Université de Sherbrooke, Canada

All reported Chair activities have so far been conducted by the senior Chair, with the help of a newly hired Chair professional. The regular staff from the Department of Mechanical Engineering (DME) also played an important role in terms of project supervision and support.

Industrial co-Chair : Russel Long, P. eng., Chief Design Engineer, Alcoa Technology Center  
Mr. Russel Long was quick to respond to my requests and was instrumental in providing aluminum for student projects. He also got advices from the Alcoa Technical Center (ATC) team regarding the equipment specifications for the assembly workshop.

b. 5 Year Term Objectives Overview

Please provide a brief overview of your Chair, its goals and objectives.

The objectives of the Chair in Design for aluminum are twofold :

1. To evaluate and integrate the strategic use of aluminum in products from a cost/benefit/performance perspective;
2. To develop and disseminate knowledge and expertise on product design, rather than prototypes, where reliability, manufacturing and assembly processes will be assessed.

c. Annual Objectives/Tasks

Please provide a list of the activities that were to be achieved in the past year and your progress toward these objectives.

Chair program : (Achievements, since May 2011 report)

1. Undergraduate training - Applying Knowledge in Aluminum Design (Mech. and Civil Engineering)
  - Gathering information & knowledge on aluminum and reliable product design;
    - ⇒ *Progress has been made toward that objective. Russell Long has pledged its support in transferring knowledge to the Chair and has extended me an invitation to spend several weeks at the ATC, this coming summer 2012.*
    - ⇒ *In April 2012, both the Chair holder and the Chair professional attended a 15 hours short course targeted at practicing engineers. The lecturer was Professor Michel Guillot from Université Laval and the course was presented by the Réseau des Ingénieurs du Québec in collaboration with the Aluminum Association of Canada and the research centre REGAL. Several relevant reference books introduced by the instructor will be acquired.*
  - Developing courses on aluminum in engineering and product optimization and validation;
    - ⇒ *No work has been done regarding the production of academic material since this step should follow the information gathering phase, just above. Nevertheless, discussions have taken place with colleagues in material science so that three new courses would be proposed as part of a new "Design material" option.*
    - ⇒ *A short course (45 min.) on "Design of aluminum products" was given by the Chair holder on October 2<sup>nd</sup> at the COM 2011 Conference of Metallurgists in Montréal and encompassed part of the material for the DME undergraduate course.*
    - ⇒ *As mentioned above, a short course on aluminum product design was presented by Professor Michel Guillot. Professor Guillot is also teaching at Université Laval a 45 hours course on aluminum product design. Some discussions will take place with Professor Guillot in order to determine whether he could be interested in presenting his course to Sherbrooke University mechanical engineering students or if some of his course material could be made available to us.*

- Setting up an assembly workshop for aluminum related students projects;
  - ⇒ *A welding station and riveting equipment have been purchased last summer with the advices of Russell Long, and the technicians from the DME. The Chair professional also attended FabTech Canada 2012 which is an important trade show that was held in Toronto in March 2012. All major distributors were exhibiting specialized equipment and machine tools. Several technologies were assessed and information was specifically gathered on cutting technologies (waterjet, laser, plasma). The purchase of a waterjet cutting equipment is being considered. This equipment will enable students to cut aluminum, composites and plastic sheet material. Budgets are being evaluated since the purchase price is around 200K\$. A proposal was also sent to the Dean of the engineering faculty in order to promote the assembly workshop project in the 2013 UdeS major financing campaign.*
- Supporting aluminum usage in undergraduate capstone design projects.
  - ⇒ *Aluminum has been provided by Alcoa for capstone projects that were completed in December 2011. Orders for aluminum are now being taken from the students scheduled to terminate their capstone projects in December 2012.*
  - ⇒ *Two projects have been defined with Alutrec, a Chair collaborator with the Centre Québécois de Recherche et Développement de l'Aluminium (CQRDA). The first project aimed at designing a dedicated Fixture/machine for the assembly of a novel flatbed aluminum trailer while the second was targeted at the design of a lowered version of the same flatbed trailer. A grant proposal was prepared by the Chair holder and was submitted to Alutrec and CQRDA. Unfortunately, even though the project did not require much contribution from Alutrec, the proposal never got to be signed by its President General Manager.*
  - ⇒ *Five new projects have been defined with Posi+, a Chair collaborator with the CQRDA. These new projects have been proposed to bachelor students at the beginning of the winter 2012 semester. The projects aimed at developing new technologies for cradle elevators trucks that are mainly used by cable and electricity companies. These trucks are normally built with steel frames and aluminum was being considered for weight reduction purposes. Unfortunately, none of these projects were selected by our bachelor students. We therefore decided to present Posi+ projects to master degree students. Although we are currently looking for master students interested in Posi+ projects, we also intend to present Posi+ projects to a new promotion of bachelor students in the fall 2012.*
  - ⇒ *The Chair is currently promoting a community project in partnership with the Sherbrooke 2012 Canada Games. The project was lately granted the approval of the 2012 Canada Games executive committee. The underlying idea is to design and build an aluminum monument representing the spirit of the games. Since the project is likely to combine arts and engineering, the Dean of Bishop's University fine arts and culture department was met. Bishop's University art students will therefore work in collaboration with Sherbrooke engineering students. Recruitment of engineering and art students will start during the 2012 summer semester.*
  - ⇒ *The Chair professional has worked in a previous job as a consultant in Alcoa aluminum smelters. Based on this experience, a capstone project was proposed to Alcoa on September 14<sup>th</sup> 2012. The equipment to be designed by bachelor students was a unique tool whose purpose was to machine the underside of an aluminum anode in order to make it flat, thereby increasing the anodes life cycle. Although the project was quite promising, Alcoa decided not to embark in its realization.*
  - ⇒ *A meeting with the Anderson Group was held on October 21<sup>st</sup>, 2011. This company is specialized in the design of farming equipment and might be interested in submitting a capstone project in a near future.*
  - ⇒ *The Chair professional visited Soudure Brault on November 18<sup>th</sup>, 2011. This machine shop is fully dedicated to aluminum welding and transformation. Potential*

*capstone projects were discussed with this company. Soudure Brault has also been very supportive of a capstone project that needed to perform basic sheet metal bending. These operations were done for free.*

- ⇒ *The Chair professional also met with TLD on March 8<sup>th</sup>, 2012. The company is specialized in airport ground support equipment. TLD is currently assessing the opportunity of building an airplane loader made with aluminum.*
- ⇒ *The Chair has met with Motrec technical personnel on April 3<sup>d</sup>, 2012. This company is located in Sherbrooke and produces small size vehicle for industrial purposes. They are currently analyzing the idea of designing an aluminum vehicle and a meeting was held to discuss a potential partnership with the Chair.*
- ⇒ *Two meetings were held with the company MC2 Recherche Internationale on April 11<sup>th</sup> and 19<sup>th</sup>, 2012. This company wants to develop submerged turbine for rivers.*
- ⇒ *A civil engineering capstone project for the design of an aluminum overhead pedestrian walkway has been proposed to the Chair of the department of civil engineering who offered the project to the students. The Chair is currently waiting to see if the project has been selected by a team.*

## 2. Graduate and post-graduate training - Creative Design for Innovative Aluminum Products

- *Development of methodologies and advanced design tools;*
  - ⇒ *Even though he is paid with my NSERC Automotive Partnership Canada grant, I have a Ph.D. student (Cristian Iorga) working on the development of integrated, detailed design and validation methodologies adaptable to various product development contexts. His work directly addresses the second objective of the Chair, as stated at the beginning of this report. This student is also the main author of the papers presented to the Canadian Engineering Education Association (CEEA) Conferences in 2010, 2011 and 2012 as well.*
- *Development of innovative products and materials.*
  - ⇒ *In July 2010, I have obtained a 11.3 million\$ total grant from the Automotive Partnership Canada, for the "Development of a hybrid propulsion roadster" with Bombardier Recreational Products (BRP). Among the many graduate students involved in the project, three master degree students have subjects in relation to aluminum structures: the first (Walid Ben Romdhane) to design a special jig for the fatigue testing of the existing vehicle frame onto a servo hydraulic machine; the second (Maxime Tacher) to design a new optimized aluminum frame for the future hybrid version of the roadster and the third (Yann Mogenot) to address the manufacturing and assembly issues of the new frame. As mentioned in the previous point, the Ph.D. student Cristian Iorga is also involved in fatigue related testing, to validate his proposed methodologies.*

## 3. Chair resources

- *Hiring a professional/Mechanical Engineer with the funds released by my salary and the Chair budget;*
  - ⇒ *The professional mandate is comprised of four elements:*
    - 1) *Canvass industry and Small to Medium Enterprises (SME) for sponsored capstone projects;*
    - 2) *Identify and channel the most promising unsponsored capstone projects toward the University start-up support organization known as the "Technological Enterprise creation accelerator" (ACET);*
    - 3) *Assist in the various chair activities toward the achievement of the Chair program, including project follow-up, course preparation, assembly workshop completion, technological watch, etc.;*
    - 4) *Manage, use and maintain a servo hydraulic testing machine for the structural*

*validation of prototypes regarding reliability and fatigue life testing, including safety issues.*

⇒ *The recruitment process was completed in June 2011 and the selected candidate started working in July 2011.*

#### 4. Other Chair matter

- Intellectual properties issues;

⇒ *After consulting the Chair partners, it has been agreed that the intellectual property most likely to arise would come from student capstone projects and master student works and that it should be negotiated on an individual basis with the companies or industrial partners involved. Otherwise, the Chair being mostly oriented toward undergraduate training, no intellectual property is expected to arise from the Chair activities themselves. Hence, a letter of agreement has been signed where partners relinquish their right to any intellectual property from the Chair endeavour.*

- Formal Chair announcement

⇒ *The formal announcement of the Chair was completed on March 19<sup>th</sup>, 2012 in close collaboration with NSERC personnel, as it should. This event was a great success and was covered by reporters so that the Chair and its partners got proper exposure in the media.*

#### d. Objectives/Tasks for Upcoming year

Please provide a list of the activities that you are planning for the upcoming year.

Chair program :

##### 1. Undergraduate training - Applying Knowledge in Aluminum Design (Mech. and Civil Engineering)

- Gathering information & knowledge on aluminum and reliable product design;

⇒ *This will definitely be a top priority for the upcoming months and year. This important task will be conducted both by the Chair holder and the Chair professional. To this end, the following actions will be undertaken:*

- 1) *Contact the Chair partners to gather information pertaining to the use of aluminum in product design (Chair professional);*
- 2) *Involve the industrial co-chair in this endeavour since this was the initial trust to designate him in the first place (Chair holder);*
- 3) *Spend time at the Alcoa Technical Centre in Pittsburgh, learning about design with aluminum and collecting case studies (Chair holder);*
- 4) *Seek information from other sources such as libraries, journals and other organizations related to material such as the National Research Council - Aluminum Technology Centre in Saguenay, Québec (Chair professional).*

- Developing courses on aluminum in engineering and product optimization and validation;

⇒ *This task will naturally follow from the preceding one. It is foreseen that the following targets will be achieved:*

- 1) *Preparation of a guide for sizing welded and riveted joints with details on the actual use of the specific tooling for riveting (Chair professional);*
- 2) *Preparation of a course document with detailed content needed to create a new undergraduate course on "Design for aluminum" (Chair professional).*

- Setting up an assembly workshop for aluminum related students projects;

⇒ *This will be a continuation of what has already been undertaken since January 2011. The selection of the riveting equipment was completed and information will*

- be sought regarding bonding products and applications;*
- ⇒ *A visit of Saguenay CTA research facility was held in April 2012. This research facility has an extensive research program that characterizes different bonding products and different bonding procedure. A reference book that summarizes the work done on this topic is going to be released in May 2012.*
  - ⇒ *Waterjet cutting technologies are being evaluated. This equipment should be very useful for capstone and research projects since it may cut very different materials such as composite, concrete, stone and aluminum in a variety of stock sizes.*
- Supporting aluminum usage in undergraduate capstone design projects.
    - ⇒ *Supporting capstone projects will be a continuous undertaking throughout the full five years of the Design Chair. Hence, aluminum will continue to be provided to the students who need some and new projects will be sought on an ongoing basis as part of the Chair professional mandate.*
2. Graduate and post-graduate training - Creative Design for Innovative Aluminum Products
- Development of methodologies and advanced design tools;
    - ⇒ *The Ph.D. student (Cristian Iorga) referred to in the preceding section will carry-on his work toward the development of dedicated methodologies for product validation at the outset of the detailed design phase, hence providing material for the "prototype to product" stream.*
  - Development of innovative products and materials.
    - ⇒ *Ongoing projects will obviously be continued. However, no new project is scheduled unless some industry sponsored project turns out to suit master degree requirements more than capstone projects. Moreover, if an industry sponsored project is not selected by bachelor students, it could be "recycled", with appropriate modification and support, into a suitable graduate student project. In the case of master degree works, it would be interesting to request that the graduate students proceed to build case studies based on their original design work. This would make graduate students achievements and experience available to undergraduate students in their capstone project years.*
3. Practicing engineers - Increased competencies in aluminum design
- ⇒ *Regarding practicing engineers, no action is planned in the first two years of the Chair operation. Focus is to be placed on getting things started with undergraduate student related activities.*

e. Impact of Semi-Annual meetings

Please describe the influence last year's semi-annual meetings have had on your Design Chair. Note any impact or changes as a result of the meetings.

In the Saint-John's summer meeting, the Chair holders presented their achievements of the past year or what they intended to do if their Chair was a new one. This was a good opportunity to appreciate the variety of Chair programs and actions within our small community. However, one objective was to discuss hurdles and difficulties and very few of us really opened up on this. Moreover, a tight and "lag gathering" schedule prevented much of the exchanges to occur.

At the Vancouver winter meeting, the focus was not initially on individual Chair progress but attendees were eventually asked to develop on their Chair achievements. Also, presentations were made by colleagues to share their experiences and visits of design laboratory across the world. An attempt to have chair holders present and comment on recent papers they thought were significant did not raise the expected enthusiasm and thus was removed from the agenda.

## 2. Established Partnerships

Briefly describe the nature and extent of the involvement of the partners. Include details on how the results have been communicated to the partners (e.g. meetings, reports) and how the industrial partners have transferred knowledge and know-how to the university students, staff, and faculty.

The Design Chair is currently supported by three partners: REGAL, Alcoa and CQRDA. The following lines will explicit the extent of their involvement.

REGAL: The REGAL is a research centre on aluminum, supported by the Fonds de recherche du Québec Nature et technologies (FRQNT), the provincial equivalent of NSERC in Québec. REGAL was instrumental in the creation of the Design Chair as it was part of its strategic plan. REGAL is also the only partner whose contribution is in cash and not contingent upon the completion of specific projects or grant proposals. Being responsible of a research axis on aluminum product design and manufacturing within REGAL, I have pledged to disseminate to all member institutions, the course material and good practices that are to be generated through the Chair activities. There is no such material yet however, but there should be some in the coming year.

Alcoa: Alcoa's contribution is in kind, but it is central to the good operation of the Chair. Indeed, it includes the involvement, as industrial co-chair, of Russell Long, Chief Engineer, Ground transportation, at the Alcoa Technical Center (ATC) in Pittsburgh. In this role, he has so far been very responsive to my requests and provided me with valuable information regarding the equipment for the aluminum assembly workshop. He is also keen to share knowledge and test case studies regarding the design of aluminum products and components in the transportation industry. Finally, Yves Archambault, from Alcoa Innovation, has been very quick and collaborative in providing aluminum for our student capstone projects. Indeed, Alcoa met every demand for aluminum from every team, in terms of quantity, shape and grade. An inventory even remains from unused sheets and extrusion lengths.

CQRDA: The contribution of the Centre québécois de recherche et développement de l'aluminium was through grants to Small to Medium size Enterprises (SME) for projects involving students from the Université de Sherbrooke. In the initial Chair proposal, two such SME had been identified: Alutrec, a maker of aluminum flatbed trailers and Posi-Plus Technologies, a manufacturer of cradle elevators for trucks. As mentioned previously, two projects were drafted with Alutrec and a grant proposal prepared for the CQRDA. However, Alutrec has finally decided not to go forward with these projects. Posi-Plus has proposed five capstone projects, which, unfortunately, did not get selected by the students at the January tendering; hence, they will be offered to a new cohort of students in September. Otherwise, as stated in section 1c) of this report, many other organizations and companies have been met in a bid to define more industry related capstone projects; Sherbrooke 2013 Canada Games, Alcoa, Anderson Group, Soudure Brault, TLD, Motrec, MC2 Recherche Internationale and the Université de Sherbrooke.

## 3. Sources of Financial Support

Please provide information about the cash and in-kind contributions received during the past year, noting the impact on the Chair activities as well as the estimated values for Chair leverage.

REGAL has completed its contribution for the past year, providing 27K\$ in cash. More specifically, 10K\$ were from the REGAL fiscal year 2010-2011 while another 10K\$ was the contribution for 2011-2012. Finally, 7K\$ were provided as a support and recognition for my efforts as one of the three REGAL research axis coordinators, a task which closely match my role as Chair holder.

As indicated in the Chair proposal, the contribution of the CQRDA is in cash for a total of 10K\$

per project that is conducted in partnership with industries. CQRDA is therefore awaiting the start of a first project to contribute to the Chair.

The contribution from Alcoa amounted to 24,3K\$ in the last year. Approximately half of this contribution was made through meetings and direct interaction with Alcoa Innovation technical personnel. The other half was provided to the chair as an in-kind contribution. Indeed, three shipments of aluminum were sent to the University by Alcoa Innovation. This aluminum was then redistributed among the capstone projects that were in their fabrication stage during the fall 2011 semester.

#### 4. Progress to Date

Please describe the progress to date made toward the following objectives.

##### a. Training

Please include all relevant information about courses developed or modified by the Chair focusing on design, the impact of these courses as well as any involvement in competitions etc. Please include the number of students impacted.

##### I. At the undergraduate level

As previously indicated, a course on *Design for aluminum* is planned as a classic way of transferring knowledge. More specifically, the course will address various topics pertaining to the use of aluminum in product design: Aluminum physical properties and cost; comparison with steel and composite materials; corrosion resistance, galvanic corrosion and surface treatment such as anodizing; assembly of aluminum components: Conventional welding, friction stir welding, riveting and bonding, multi-material assembly; design criteria: Safety factors, ultimate strength, yield strength, fatigue resistance, endurance limit, rigidity (strain); application spectrum and typical design guidelines and ratios for the productive use of aluminum in components and products; case studies and examples of aluminum products. The course content will be assembled using knowledge and references from the industrial co-chair and my colleagues from the REGAL research Centre. This task should be completed in the coming year or two. The exact title and final scope of the course still need to be finalized however.

##### II. At the graduate level

The focus of the Chair is mainly targeted toward undergraduate students on whom it hopes to have the biggest impact. Nevertheless, part of the Chair program includes graduate student training mainly through projects related to the Chair objectives. More specifically, these projects will connect to one of two research streams: *advanced methodologies and design tools* or *the development of generic aluminum-related design technologies*. In either case, these projects will fit the requirements for the research-based track of the master's degree program or the new integrated bachelor's-master's degree program. This last program however, is still under development at the faculty and department levels. The Design Chair will most certainly be involved in the discussions related to it, as this is also seen as a unique opportunity to add course content related to *Material selection and assembly in design* or *Design for aluminum* as well as *Design from prototype to product*. There is no timetable set for completing and starting the integrated bachelor's-master's degree program as this initiative has been faced with hurdles in the way of financing and course credit dual recognition. In any case, a reasonable guess would be that it should be up and running in the coming year and a half.

Regarding actual graduate student projects, my Ph.D. student Cristian Iorga will continue its work on the development and integration of validation methodologies as a means of feedback

toward those product specifications targeted at reliability, production and cost. Another student, Maxime Tacher, is pursuing its master degree work on the design of a new aluminum frame for the CAN-AM roadster by Bombardier Recreational Products (BRP). Finally, a third student, Yann Mogenot, is covering the manufacturing and assembly aspects of the frame. Additionally, if Posi+ sponsored projects do not appeal to students as capstone projects, these could be offered as master degree subjects. We should know more regarding this possibility in September as a new wave of students must choose their capstone projects in the fall semester.

#### b. Design and Development

Describe all relevant information about the design and development of innovative products, processes, systems and technologies.

Design and development of innovative products is central to the Chair on Design for Aluminum and the Université de Sherbrooke Mechanical Engineering program. It might be worth describing shortly the projects which have been provided with aluminum from Alcoa.

The first is Maelstrom (7 students), which is, as its web site puts it, "an academic project which aims to design and build a mobile underwater turbine adapted to Quebec's rivers to harvest the province's hydrodynamic potential".

The second project to have benefited from Alcoa's aluminum is hUSki (7 students), whose aim is to design and construct a sled to allow injured people to be rescued and towed by a snowmobile in mountain ski resorts. This project is to provide a new tool for the Canadian Ski Patrol at the small Moncalm ski resort in Québec.

The third project that received aluminum is the Uski team (6 students), whose mandate was to design and construct an equipment for handicapped cross-country skier. The users of this device can perform cross-country skiing without using their legs.

A fourth team was also given some aluminum. Indeed, the GSC project which was composed of 6 students has used aluminum to construct its Giraffe Sideline Camera. The equipment is essentially a camera installed on a retractable pole system which may lift the camera up to 12 meters in order to film the "Vert et Or" football games.

Finally, the last project that received aluminum was Kruser53 (12 students). The team has designed and constructed a single place submarine propelled by human force.

All projects were presented at the annual DME project exhibition in December 2011.

#### c. Collaboration

Describe any collaborations and interaction of the Chair with the department, faculty, university and outside colleagues during the past year in connection with the CDE action plan. Include collaborations with other CDEs, but do not include the Chairs regular workshop meetings.

Considering the history of the DME as a leader in project based learning and the many partners involved in the Chair, collaboration is definitely a strong aspect of the Chair. At the DME level, I benefit from the backing and experience of François Charron, head of Department and former Design Chair holder. He remains an indefectible advocate of design and project-based learning. I can also count on the strong support from Patrik Doucet, the associate dean academic who is the professor responsible of the general follow up of the capstone design projects in Mechanical Engineering. Otherwise, the professors in charge of the capstone design courses (Cécile Smeester, Jean-Sébastien Plante and myself) have been exchanging a lot lately on the number, length, content and timing of the "short courses" that punctuate the design courses themselves.

At the provincial level, the REGAL Research Centre is due to renew its support from the FRONT in

the coming year. As responsible of the research axis on design and manufacture of aluminum products, I will be actively involved in the definition of the research program and activities of the REGAL Centre for its second mandate. This provides an invaluable opportunity to link the Chair actions to the research centre future program, hence creating stronger bonds with other academic and industrial partners.

Regarding the relations with the other Design Chair holders, it is envisioned that a meeting be organized this coming summer with Abderrazak El Ouafi, holder of the Design Chair at Université du Québec à Rimouski. Collaboration avenues will be investigated regarding projects follow up tools and course contents.

#### d. Promotion

Describe any events and activities that were organized to raise the awareness and appreciation in the research and outside communities for all aspects of design engineering.

The Chair was involved in an activity that was organized by the Trans-Al network. The activity titled "*L'aluminium matière à innovation*" was held in Sherbrooke in November 2011 and gathered approximately 60 small size businesses. The main discussion topic was aluminum in product design. Different key players from governmental agencies also presented their program targeted at small size businesses interested in product design and development. The Chair in design for aluminum promoted the use of aluminum and also described the partnership possibilities available to small size businesses that could be interested in working with the Chair.

On April 18<sup>th</sup> 2012, the Chair holder was invited to lecture aluminum related business in the Saguenay region about partnerships that can be established with the CTA-UdeS-BRP (Centre des Technologies Avancées) and the Chair in design for aluminum. The Chair also promoted its activities in a commercial fair that was titled "Innovation partnership 2011". This event that was held on November 22<sup>nd</sup> was organized by the Quebec ground transportation cluster. The Chair professional met a few industrials that could be interested in capstone projects.

The Chair has also met with the Aluminum Association of Canada on March 13<sup>th</sup> 2012. It has emerged that collaborative projects could potentially be implemented in the years to come especially regarding the training of practicing engineers. The Aluminum Association of Canada is definitely a key player in promoting the use of aluminum in product design.

### 5. **Problems Encountered**

Identify the main problems encountered during the past year, their impact and the steps taken to resolve each issue.

The major problem encountered was the four months strike of the support personnel which impacted the university operations and caused some delays in the Chair activities. Nonetheless, the Chair is now operating normally and promoting aluminum in product design. As mentioned previously, identifying industrial capstone projects and having them be chosen by students also proved to be both challenging and time consuming. Regarding Alcoa's contribution, keeping track of the amount of time devoted by their personnel toward the Chair activities and objectives as well as getting the exact value of the aluminum provided to the projects does not appear to be a trivial task either.

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<sup>1</sup> In this document references to Chairs in Design Engineering (CDE) also should be interpreted as referring to Chairs in Environmental Design Engineering (CEDE).