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NSERC Chair for Women in Science & Engineering, BC and Yukon Region

# 24-MONTH PROGRESS REPORT

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September 1, 2012

Chairholder:

Dr. Elizabeth Croft, Ph.D., P.Eng., FEC, FASME

NSERC Chair for Women in Science and Engineering (BC & Yukon Region)



Chair for Women in  
Science and Engineering  
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Westcoast Women in  
Engineering, Science  
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## 1 Highlights

As the NSERC Chair for Women in Science and Engineering (BC & Yukon Region), Dr. Croft founded Westcoast Women in Engineering, Science, and Technology (WWEST) in order to: attract, recruit, and retain women in engineering and science. WWEST works at national, regional, and local levels with organizations engaged in increasing the number of women in science, engineering, and technology (SET) disciplines through multilateral partnerships spanning community, academic, and private sector partners. WWEST serves as the premier hub for activity and dialogue about meaningful inclusion and increased participation of women in SET disciplines on Canada's west coast. Nationally, Dr. Croft leads the NSERC CWSE national network and serves on the Engineers Canada Women in Engineering Committee.

A research highlight is our collaborative project on Health and Well-being in the Workplace with Professor Toni Schmader, Canada Research Chair in Social Psychology, investigating ways in which workplace social interaction contributes to the health and career satisfaction of professional engineers, especially women. Preliminary findings indicate that negative interpersonal experiences, such as workplace exclusion, may be significant predictors of physical and mental health, even after controlling for fitness and lifestyle factors. Moreover, negative experiences may affect women differently than men, possibly reducing commitment to remain in the same job.

WWEST has worked with the Canadian Centre for Women in Science, Engineering, Trades and Technology (WinSETT Centre), to present six "Becoming Leaders" workshops, a professional development opportunity for women in SET. These workshops were hosted with industry partners and addressed challenges and solutions for women's success in SET careers. WWEST measured statistically significant positive changes in participant occupational self-efficacy across a five of six key indicators and presented these findings at the CCWESTT conference in May 2012. WWEST will highlight new WinSETT workshops at the upcoming APEGBC Annual General Meeting in Victoria, October 2012.

In September 2011, WWEST organized the second biennial Creating Connections conference, at UBC, convening 150 female engineering students, new immigrants, women in transition, and industry professionals for a full day of networking, personal and professional development, and leadership modeling. WWEST is organizing the next Creating Connections conference (May 11, 2013) and has engaged key personnel from partner groups (including SFU, UVic, SCWIST, DAWEG, WIE-VR, Women in Mining, etc.) to take on leadership roles on the planning team. The aim is for this conference to be self-sustaining by the time that the Chair is complete, meeting the larger CWSE Network objective for regional conferences to complement the biennial CCWESTT conference.

The Chair has worked closely with the Faculty of Applied Science Engineering Community Service Learning (CSL) Working committee to advocate for and develop CSL curriculum throughout engineering. Dr. Croft spearheaded the development of a CSL unit taken by all second year Mechanical Engineering students since 2010 while supporting development of CSL programming across the Faculty. She also developed and delivered a set of two, CSL-based *Global Engineering Leadership* electives for senior students delivered in 2011 and 2012. Since the beginning of the Chair, over 1000 students in engineering have participated in CSL engineering courses.

The WWEST Partners grant program fosters exciting new initiatives that promote the outreach, recruitment, and retention of girls, young women, and industry professionals in SET. Partners work across SET disciplines with a broad range of target demographics, ranging from GEERING UP! UBC Engineering and Science for Kids, bringing hands-on science to youth in Greater Vancouver, to the Society for Canadian Women in Science and Technology (SCWIST), supporting students and industry professionals. All WWEST Partners participate and benefit from biennial training sessions provided by WWEST covering key topics like succession planning, fundraising best practices, succession planning and project management.

## 2 Progress to Date

### 2.1 Contributions

WWEST has made broad, national and regional contributions through a combination of policy and advocacy work, coordinating and building capacity in regional activities, and proving pilot projects to assist in mainstream integration. Our work spans multiple age groups – early outreach, post-secondary, and industry – and sectors, concentrating on areas of strategic importance to our region: mining, utilities, and consulting engineering. Each one of our activities contributes towards one or more of the overall goals of the NSERC Chairs for Women in Science and Engineering program.

#### 2.1.1 Develop, implement, and communicate strategies to encourage female students in the K-12 system to consider careers in SET.

WWEST has undertaken three distinct strategies to encourage female, K-12 students to consider futures in SET, all of which leverage other stakeholder groups to both increase our reach as well as encourage the long-term continuation of our programs.

Firstly, we have developed a teacher training session with UBC Engineering Recruitment, in which we introduce easy to implement, affordable, SET classroom activities, directly correlated with the Prescribed Learning Outcomes of the high school curriculum, to teachers in a Professional Development Workshop format. The workshop demonstrates the activities and discusses how they can be used to encourage and foster critical inquiry and thoughtful reflection by students about the role of SET in society. A short keynote address by Dr. Croft emphasizes the role of a teacher in a student's decision to pursue a future in SET and how an understanding of how SET serves our society can be particularly encouraging to women who are considering a SET career.

Another successful initiative has been our WWEST Partners program, a program closely aligned with the objectives of the NSERC CWSE program. WWEST Partners are a network of non-profit, institutional, and not-for-profit groups in the region whose work is concerned with outreach or retention. The WWEST Partners program seeks to build a community of practice and to provide financial and expertise resources that help community members to learn, share, and disseminate best practices and build towards the long-term sustainability of their respective programs. WWEST provides up to three years of seed funding (generally with annually declining amounts to encourage partners to seek alternative funding sources), semi-annual training sessions on selected topics, and networking and collaborative activities among respective groups. Our WWEST Partners in the K-12 outreach area include:

- UBC GIRLsmarts Computer Science workshops
- Girl Guides of Canada workshops at SOAR international camp
- Girls Exploring Physics workshops at Simon Fraser University
- UBC Physics and Astronomy Outreach Program
- GEERing Up! UBC Engineering & Science for Kids workshops and camps in Vancouver, Kelowna, and Prince George
- IEEE Women in Engineering STAR outreach program

In addition, WWEST actively seeks and participates in activities organized and coordinated by regional organizations, providing booths, role models, speakers, leaders, publications, or other content for their activities. For instance, we have presented at events that are a part of Engineering Week, a week-long celebration of the engineering profession organized in BC by the Association of Professional Engineers and Geoscientists of BC (APEGBC), such as the EFest fair at the downtown Vancouver Public Library and a popsicle stick bridge-building contest on the Sechelt Peninsula. WWEST also presented at and providing mentors for the UBC Go Eng Girl! Conference for high school students. By making partnership a cornerstone of our outreach strategy, we have been able to maximize our impact, share our expertise and best practices in a very personal and practical way, and build capacity in our region to continue developing and holding events to support women in SET after the end of our mandate.

### **2.1.2 Develop, implement, and communicate strategies to increase the enrolment of women in SET undergraduate and graduate programs**

Based on social science research on key factors for career selection by young women, WWEST has strategically focused on advancing curriculum that promotes SET as a welcoming career for young women, and that promotes opportunities to make a positive impact on society. The Chair has utilized her position to advocate for and establish courses integrating Community Service Learning (CSL) into curricula across the Faculty of Applied Science at UBC. She has served on the CSL working committee since its inception in 2010 and worked very closely with Alaya Boisvert, the Faculty CSL coordinator, to share best practices across the faculty and to link CSL pedagogy with the *Graduate Attributes* required for accreditation of engineering programs. CSL is now a core component the second year Mechanical Engineering Program, in third- and fourth-year mechanical engineering courses, and courses in Chemical and Biological Engineering and Civil Engineering. Furthermore, the Dr. Croft has developed a set of two CSL “Global Engineering Leadership” (GEL) courses that are taken as electives by senior students. Dr. Croft has also partnered with the UBC International Service Learning (ISL) office to include a 6 week ISL placement in Mexico in the second GEL course, allowing students to utilize their engineering skills in a service learning context for an international development project. Since the start of the Chair, nearly 1000 UBC Engineering students have benefitted from participating in CSL learning opportunities in APSC, more than tripling the annual number of engineering students participating in CSL. We have also seen a marked increase of women students entering Mechanical Engineering – with traditionally very low enrollment of women, up to 18% from a pre-chair average of about 13%.

More broadly, our outreach to this group parallels our strategy for K-12 students. Because there is a strong group of organizations working in this area, we have focused on supporting the WWEST Partners programs. In particular we have brought partners together to co-host events, provided connections with sponsors and speakers, and participated in WWEST Partner events and activities as speakers, mentors, presenters, facilitators, or in other invited roles.

Our WWEST Partners in the post-secondary area outreach and support are:

- UBC-O Women in Science and Engineering career workshops and mentoring
- UBC WISE networking night
- BC WIE and SFU WEG Enhancing Collaboration Initiative
- SFU WEG and SFU WICS Corporate Opportunities Program
- BC Young Women in Physics Canada Conference
- Leadership through Diversity at the University of Victoria

Furthermore, Dr. Croft has been a keynote, presenter, or mentor at 15 events for over 1,100 students at campuses throughout the region including multiple presentations to the Women in Science and Engineering Groups at UBC, UBC Okanagan, UVic, SFU and BCIT as well as college groups. In addition, WWEST hosted an informal panel and lunch for incoming female university students and senior high school students during the UBC Engineering Open House. Through our WWEST partners program we have facilitated close networking and cooperation between these WIE/WISE groups across the region, leading to collaborative events such as a recent trip to Boeing in Seattle. By bringing these groups together we help to increase “critical mass” of women students events, an important strategy to reduce isolation, improve networking, and support recruitment and retention.

### **2.1.3 Develop, implement and communicate strategies to increase the profile and retention rate of women in science and engineering positions**

Our focus on increasing the retention rate of women in SET has centered on the young professional level – women who have been working in industry for three to seven years. The core of these activities has been implemented in cooperation with the WinSETT Centre. We have held six Leadership Development Workshops in four different communities, and assisted with continuous improvement of the material and delivery, building a set of best practices that is being implemented across the country.

We also added a more scientific approach to workshop impact measurement to help validate their impact. Our *Self-Efficacy Study* goes beyond measuring outcomes based on participant direct feedback, by measuring changes in career self-efficacy, a predictor of persistence in a career. We adapted Rigotti, Schyns & Mohr's *Occupational Self-Efficacy Scale: Structural and Construct Validity Across 5 Countries* (2008) into a specific pre- and post- model and obtained UBC Behavioural Research Ethics Board approval for a study on the impact. We have found that there is a statistically significant change in self-efficacy before and after the intervention, and are now engaged in follow-up research to analyze whether those changes persist. Our findings were presented at the CCWESTT conference in May 2012. WWEST has also been invited to present the WinSETT workshop series, our self-efficacy findings, as well as our workplace research study (described in Section 2.1.4) with Professor Schmader in a series of three workshops at the APEGBC Annual General Meeting in October 2012. This work will also be profiled in an upcoming issue of the APEGBC bimonthly Magazine "Innovation."

WWEST Partners groups also actively engaged with profiling and retention activities are:

- The Society for Canadian Women in Science and Technology (SCWIST)
- Women in Engineering, Vancouver Region (WIE-VR) in partnership with the Division for Advancement of Women in Science and Engineering (DAWEG)

#### **2.1.4 Develop, implement, and communicate strategies to eliminate barriers for women who wish to pursue careers in science and engineering**

WWEST actively engages industry partners to identify and eliminate barriers for women in SET. Activities in this area include the Women in Engineering Leadership Forum, research on engineering workplaces, and the UBC climate studies in Science and Engineering.

The Women in Engineering Leadership Forum has a membership of high-profile and highly successful women in SET, who meet several times a year to develop strategies, suggest policies, and gain ideas about how to reduce barriers for other women in their organizations.

In cooperation with Professor Toni Schmader, CRC Chair, and Ph.D. Candidate William Hall from the UBC Department of Psychology, WWEST is investigating stress in engineering and science workplaces including some of our Chair industry partners. The *Health and Well-being in the Workplace* project examines two key aspects of how a workplace might counteract daily stress and contribute to your health and well-being: the policies that promote a safe, rewarding, and inclusive environment and the interactions you have with others during your day. The results and best practices will be published and shared widely including dissemination to industry via APEGBC channels as noted in Section 2.1.3.

Dr. Croft is a co-principal investigator of the *Faculty Working Climate* study undertaken in the Faculties of Science and Applied Science at the University of British Columbia. This study seeks to identify, understand, and remediate aspects of the academic climate that are creating barriers. The faculty survey has been prepared, received university behavioural research ethics approval, and will be launched in September 2012. This study is financially supported by the Deans of Science and Applied Science at UBC as well as the UBC Equity Enhancement Fund. Dr. Croft also chairs the UBC Applied Science Working Climate and Equity Committee, charged by the Dean with preparing the survey and developing an action plan to address the findings of this study.

#### **2.1.5 Develop, implement, and communicate strategies to promote the integration of female students and professionals both within and outside academia**

Work to increase the integration of women into fields traditionally associated with men has been a priority for WWEST. We have organized a number of dual gender events such as a teacher's conference, EFest at the Vancouver Public Library, and open houses. These events provide WWEST the opportunity to communicate the challenges and barriers to full female participation in SET both in academia and in industry. Moreover, WWEST specifically seeks a number of mentors and role models, both men and women, from all walks of life who are champions for inclusivity to serve as supporters and presenters at

our events, highlighting the fact that diversity is defined broadly and the integration of women is everyone's concern. In addition, Dr. Croft presents an annual a salary seminar to female upper-level Engineering students for a number of years, focusing on ensuring that young women transitioning into their first professional roles have the tools to make informed decisions about their futures in industry and academia. This seminar is now offered at SFU and UBC Okanagan and is available on the WWEST website.

WWEST has sought to help enact change at the organization level in the community, not only at the level of individual women. By doing so, WWEST seeks to educate and equip change leaders in organizations in order to generate cultural shifts towards inclusivity, diversity, and support. Members of the Chair's Steering committee include the Deans of Applied Science (Engineering) from all three major engineering schools in BC, the Dean of Science at UBC, leaders from major employers (BC Hydro, Worley Parsons, Stantec), industry advisory (DAWEG) and student representatives. Through our Biannual meetings, the Chair has worked with these key leaders to promote the Engineers Canada 30x30 plan (30 percent licensed female engineers by 2030 – see Section 2.1.7 for details). At our most recent advisory meeting the Dean of Applied Science proposed to double the intake of women into engineering at UBC by 2020. Dr. Croft is working closely with the Assistant Dean of Student Services to develop this plan.

Dr. Croft is also working with council members from the Association of Professional Engineers and Geoscientists of BC, including the current president to develop an action plan to attract, engage and retain women in the profession. These recommendations are planned to go before council in 2012/13.

#### **2.1.6 Providing successful and accomplished female researcher role models**

Dr. Croft is a well-recognized researcher and engages in a number of profile-raising events and activities. She is frequently featured in the media, speaks regularly at community events, and has been featured in both a local museum exhibit as an inventor and as a BC Year of Science Featured Scientist. She has been a keynote speaker for events like the SCWIST 2011 Gala, and the Association of Professional Engineers and Geoscientists of Alberta 2011 Mentoring Conference.

WWEST has also played a very active role in nominating local female industry and academia leaders for awards, and raising their profile in the community through guest speaking opportunities, local events, and web profiles. Recent WWEST nominations include: Catherine Roome, CEO BC Safety Authority, winner of the APEGBC McLachlin Award (2011)– the premier career award for an engineer in BC, winner of the Engineers Canada Award for the Support of Women in Engineering (2012) and a YWCA women of Distinction Nominee (2012)); Margaret Li FEC, Past APEGBC president, winner of the APEGBC Professional Service Award (2012); Robin Farnworth, winner of the UBC Engineering Young Alumnus Award (2011); Nicole Kohnert, nominee for UBC Alumni Award of Distinction. Dr. Croft also oversees the Canadian Federation of University Women (West Vancouver Chapter) Education Award nomination process at UBC. In 2011 three UBC Engineering students received a \$1000 award from this group.

#### **2.1.7 Developing and implementing a communication and networking strategy to ensure a regional and national impact on opportunities**

WWEST functions as a regional and national hub for communications about the issues affecting women in SET, liaising with stakeholders from ranging from government to industry, from academia to the general public.

The WWEST Network is composed of individuals who are subscribed to our email digest or are connected to us through social media (Facebook, Twitter, and LinkedIn). The Network focuses on the dissemination of timely information to individuals about new initiatives in women in SET as well as news about our partners and stakeholders. The Network comprises the backbone of WWEST's communications strategy, enabling Network members to remain apprised of ongoing developments in women and SET. The WWEST Partners, a key networking group described in 2.1.1, are an important part of the Network, contributing more than three quarters of the content.

The WWEST Council is comprised of representatives from the Partners group as well as a number of key stakeholder organizations. The goal of this 22 member Council is to be an information and support network for groups engaged with the advancement of west coast (BC/Yukon) women in SET, providing a point-of-contact for coordination of programming and reporting on opportunities of interest to all constituent groups. WWEST facilitates the work of the Council by serving as a central communications hub and coordinating shared activities. Through the WWEST Council we have expanded networking opportunities for women in SET, received input on policy development to address systemic inequities, and disseminated business case and best practice information to support girls and women throughout the SET community.

Dr. Croft has taken the role of Lead PI for the CWSE National Network, facilitating interactions among the five regional Chairs to enhance the visibility and impact of CWSE activities at national and international levels. The regional Chairs work together on a number of national initiatives: research projects, dissemination of current statistics and research findings and liaison with national organizations (e.g. CCWESTT, Engineers Canada) and international (e.g. INWES). Dr. Croft has served as the Network's liaison to Engineers Canada's Women in Engineering Advisory Group and has presented at CCWE+20 and CCWEST conferences on behalf of the Network.

As Network lead, Dr. Croft has gathered a team to work on a SSHRC PDG grant (deadline November 1, 2012) currently titled "Bridging the Gap: Reworking the Social Contract for Women in Engineering Workplaces – Moving from Attrition to Retention and Advancement". Participants on this grant are Valerie Davidson, Toni Schmader (UBC Psychology), Michelle Innis (U of A Business), and the NSERC CWSE Network. WinSETT, the Engineers Canada WIE committee, and the Mining Institute Human Resource Council are proposed as partners for this grant. Focusing on women in industry, this project will characterize organizational best practices, analyze interventions, and perform workplace culture studies, while building a national team comprising institutions, government and industry groups and major SET companies to create workplace culture change which welcomes and supports diversity as an economic driver. In concert with the Engineers Canada vision of 30% licensed female engineers by 2030; this grant aims to have a significant positive change not only for engineering, but for all of SET. As a deliverable, the team will develop roadmap for a full SSHRC Partnership Grant. The larger vision of the Partnership Grant will be to mobilize resources, policies and broad social consciousness to reverse attrition and address the systemic "chilly climate" that continues to freeze women out of SET careers in Canada.

Dr. Croft is also working with other chairs on the CWSE Network *Career Transitions Survey* of undergraduate (final year) students in engineering and computer science to evaluate their education experiences, career intentions and workplace expectations. Findings from this study were presented at the ICWSE 15 conference, Adelaide (Australia), July 19-22, 2011: Fender, J., Davidson V., Vassileva, J., Ghazzali, N., and Croft, E. "Perceptions and Experiences of the Workplace among Canadian Computer Science and Engineering Students – A Gender Analysis." With Nadia Ghazzali and Valerie Davidson, Dr. Croft is also developing *National Institution Support Indicator Surveys* for faculty, institutional leaders and students. This work, in part, parallels the *Faculty Working Climate* study described in Section 2.1.4. These surveys will be disseminated through the CWSE national network for use as both a national survey and also as templates for internal university use.

Dr. Croft serves as a member of the Standing Committee on Women in Engineering (a committee of the board of Engineers Canada) and serves on the Research Subcommittee. In May 2011 the Board of Engineers Canada approved the formation of this committee in order to carry out an action plan towards the goal of achieving 30% women in engineering by 2030.

WWEST coordinated the production of a twelve page "Coast to Coast" magazine summarizing the efforts of the CWSE Network, distributed to all participants at CCWESTT 2012. An electronic version has been provided to the chairs and to NSERC for dissemination throughout their connections.

## 2.2 Objectives

WWEST's mandate to attract, recruit, and retain women in engineering and science in BC and Yukon was proposed and enacted through three goal areas: (1) awareness and outreach via a WISE network resource, (2) recruitment via Community Service Learning Activities, and (3) retention and industry support through research and best practice dissemination. As described in Section 2.1, we have made substantial progress in all of these objectives and have made contributions well beyond these goals.

**Awareness and Outreach** through the development of networks and partnerships has been extremely successful. As described in Section 2.1.1 and 2.1.2 the WWEST Partners program has been highly successful in reaching out to many audiences. We have also established the WWEST Council with 22 members. The Creating Connections Conference series is very successful and has served as a focal point to bring together many of the stakeholder groups leading to the establishment of the WWEST Council and many new partnerships. Our professional training program for teachers also has significant multiplier effect.

WWEST **recruitment** goals are being met through the work described in 2.1.2, particularly the development of CSL curriculum as planned in the original proposal. Due to other curriculum constraints it was not possible to develop a first year CSL course as originally planned. However CSL curriculum has become embedded in second, third and fourth year courses across the faculty and is steadily reshaping the view of engineering as a career that truly serves society and is welcoming to diverse groups.

**Retention and Industry support** goals are being met by the research work described in Sections 2.1.4 and 2.1.7 to study and develop best practices to support women in academe and industry. However we have already moved to practical interventions – namely the Leadership Development Workshops (Section 2.1.3) to help women develop networks and strategies to remain in these careers.

In terms of **success indicators**, as outlined in our proposal we have used survey tools (See section 2.1.3) to evaluate our interventions and reported outcomes in yearly reports to sponsors and stakeholders (also posted at wwest.ca). We are also collecting statistics from our WWEST partner projects but, as most projects are multi-year, results are still coming in. We have developed CSL curriculum and documentation of the CSL program outcomes will follow in the latter part of the Chair mandate; meanwhile our participation rates in CSL have been excellent (Section 2.1.2). We have started to report our early research findings (Section 2.1.3 and 2.1.4) and expect that in the last three years of the Chair a greater emphasis on reporting will take place as our studies are completed.

## 2.3 Collaborations

As discussed in Section 2.1.7, Dr. Croft has established collaborations with all of the CWSE chairs and currently leads the network providing support, sharing resources and strategies and working together on projects such as the Partnership Development Grant, Career Transitions Survey and Institutional Indicators Surveys. On important but basic level, at the start of the three new CWSEs in Atlantic, Ontario and Prairie regions the WWEST manager, Jennifer Pelletier, spoke with the other CWSE's new managers to share organizational best practices and strategies.

Nationally, Dr. Croft has also established strong partnerships with Engineers Canada (Section 2.1.7), and WinSETT (Section 2.1.3). Through the WWEST Council we have developed links with 22 regional groups. The WWEST Partners program currently supports 15 different initiatives run by outreach groups. This highly collaborative approach has had impact in terms of contacts with community and target groups far beyond what could ever be done by WWEST on its own.

Support of the industry partners has been excellent, through participation on the WWEST Steering Committee (Section 2.1.5), participation, hosting, and providing speakers for the Leadership Development Workshops (Section 2.1.3) and participation in the Workplace Study (Section 2.1.4) as well as participation in our many other events. Almost all of our 13 sponsors have been engaged in WWEST activities.



## 2.4 Team Members

A flexible team of involved, committed staff and students supports the Chairholder and the WWEST program. To ensure the team is as connected and integrated with the wider university community as possible, all staff work part time with WWEST and part time in other positions on campus (majority in Mechanical Engineering). This allows us to bring expertise and resources from a wider range of areas, have a wider skill set on our team, and gives flexibility to have additional staff on hand for events.

The team includes a Manager (part time), a Program Assistant (part time), a Community Service Learning coordinator (part time), undergraduate students (through co-op, work study, or work learn), a Ph.D. candidate, a research support postdoctoral fellow, collaborators (as described in 2.3), and casual, event-specific volunteers. As the Chair also serves as the Network Coordinator, a Network Program Assistant (part time) also works closely with the staff, under the Manager's supervision.

The Manager position has been held by Jennifer Pelletier, who also holds the position of Manager of Undergraduate Affairs and Special Projects for UBC Mechanical Engineering. Her educational background is in adult education and project management, and she has experience in communication and engineering and science outreach. In addition to her roles in project planning and managing the program, she has made significant contributions to training workshops such as the Leadership Development Workshops presented with WinSETT, the WWEST Partners training days, and the Teacher's Conference training. She has also been involved with our Self-Efficacy studies, and produces all of our communication pieces and graphic design elements. For her outstanding service and dedication to UBC and the faculty, staff and students that she works with, as well as her large community service portfolio, Jennifer won the UBC President's Staff Award in 2010 and the Applied Science Staff Award (Management Category) in 2012.

The Program Assistant position has been held by Heather Gerrits (until July 2011), Kyle Philibert (July 2011 – April 2012), and Justin Yang (May 2012 to present). Each was also appointed in the Department of Mechanical Engineering as a Program Assistant in the Undergraduate Affairs office. Gerrits holds a BA in Psychology from Simon Fraser University, and played an important role in setting up administrative processes, coordinating meetings and email communication. She is now at the University of Saskatchewan. Philibert holds a BAsC in Mechanical Engineering from UBC, and made contributions in the same areas, as well as playing a key role in recruitment and designing activities. He now works at Westport Innovations. Yang holds a BA (Hons) in English and a BSc in Biology from UBC. A member of the UBC Senate, he is very knowledgeable about policy creation and non-profit management, and will be contributing to the SSHRC grant discussed in section 2.1.7.

The Community Service Learning Coordinator position is situated within the Faculty of Applied Science. The position has been held by Alaya Boisvert, who has provided a great deal of support for the community service learning pilots discussed in section 2.1.2. She holds a BA in International Development from McGill and a MSc from the Blekinge Institution of Technology in Strategic Leadership Towards Sustainability.

WWEST has also hired a number of co-op, work study (domestic), and work learn (international) students annually not only to contribute to the Chair's work but also to reach out to undergraduate students in a way that complements professional development with personal passion. Students working for WWEST have received the opportunity to build valuable on-the-job skills that are transferable into future careers in engineering and science as well as gain unparalleled insight into the ways in which diversity in these professions is an asset. For example, students have helped organize the Creating Connections conference, liaising and networking with high-profile female industry professionals and scholars leading to long-lasting professional mentorship relationships. They are also given the opportunity to share their experience and knowledge with secondary school students, teachers, their peers, and the general public. In addition to providing the skills and person hours required to complete our projects, students leave their work terms, invigorated with a sense of social justice and passion for

ensuring equity in their professions, ready to act as changemakers in whatever organization they find themselves. Our undergraduate student employees have been:

- Krista Thielmann, Mechanical Engineering, Work Study, September 2010 – April 2011
- Kelsey McMartin, Mechanical Engineering, Work Study, September 2010 – April 2011
- Courtney Tiechko, Biology, Co-op, January – April 2011
- Anoushka Rajan, Mechanical Engineering, Co-op (May 2011 – August 2011, May 2012 – August 2012), Work Study (September 2011 – April 2012)
- Amanda Li, Mechanical Engineering, Co-op, May 2011 – August 2011
- Katherine Dennert, Civil Engineering, Work Study, September 2011 – April 2012
- Jonathan Leung, Mechanical Engineering, Co-op, September 2011 – December 2011
- Andrea Monssen, History and Economics, Co-op, January 2012 – April 2012
- Mina Arabkhedri, Mechanical Engineering, Work Learn, May 2012 – August 2012

Ph.D. candidate William Hall from the Department of Psychology is a leader in the workplace study described in 2.1.4. Working under our collaborator Professor Toni Schmader, CRC, Hall has developed the study protocols, secured ethics approval, and is collecting the necessary data.

Postdoctoral Fellows Chris Parker (2010-2012) and Amir Haddadi (2012-) have supported the Chair enormously by providing leadership in the CARIS Lab, allowing the Chair to maintain her research profile and experimental robotics program (see Section 2.6) while leading the CWSE BC/Yukon program – something that would not have been feasible without their support. In addition, the postdoctoral fellows have provided numerous robotics demonstrations to the general public at open house events and, in particular, to participants in the GEERing Up! summer camps, Teck Trek, and Aboriginal Summer Science program. Chris Parker has represented the CARIS lab on CBC Radio's "Spark" program.

The CWSE Network Program Assistant position is currently held by Jasreyman Noor Teja, who also has responsibilities to the Mech 2 program and graduate student admissions in the Department of Mechanical Engineering. Her background is in the area of mining.

## 2.5 Expected Sustainability

WWEST has fostered its Partners and Council networks into relatively mature states, facilitating connections among most of the university women in engineering programs in the region. Moreover, WWEST continues to deliver training and networking opportunities in order to develop capacity within individual partner organizations for continuous growth and collaborative planning. For our next Creating Connections, scheduled for May 2013, a number of WWEST Partners have been engaged to participate in core conference planning processes, including registration, programming, and marketing. We expect that the 2015 conference will be led other groups.

By using CSL curriculum development as a tool to encourage recruitment we have ensured that these efforts will be part of the mainstream engineering program at UBC for years to come. Our *Self-Efficacy Study, Health and Well-being in the Workplace* project and *Faculty Working Climate* study will be completed and results disseminated before the completion of the chair as will the CWSE Network's *Career Transition Survey*. The *Institutional Indicators Project*, the Partnership Development Grant and our industry retention initiatives have been undertaken with long term partners including the other NSERC CWSEs, WinSETT, APEGBC, Engineers Canada and social science researchers such that the activities and outcomes of our work will be sustained beyond the term of the Chair.

## 2.6 Research

Dr. Croft runs an innovative research program in human-robot interaction with a focus on industrial and assistive robotics applications. As Director of the Collaborative Advanced Robotics and Intelligent Systems (CARIS) lab, Dr. Croft oversees an interdisciplinary, international research group and is primary supervisor for one postdoctoral fellow, one research engineer, 3 PhD candidates, and 5 MASc candidates and co-supervisor for a further two Ph.D. candidates and two Masters students also working

in the CARIS lab. In the past year, Dr. Croft has published 14 articles and 4 abstracts on her research in Human Robot Interaction in peer reviewed international journals and conferences, with a further 5 articles currently in the review process. Her research program is funded by General Motors, Hyundai Heavy Industries, CFI and NSERC and attracts approximately \$400,000 of research funding per year (excluding graduate student scholarships and CWSE program funding and industry donations).

Dr. Croft continues to participate actively in a number of roles within the Department of Mechanical Engineering, the Faculty of Applied Science, and The University of British Columbia at-large. As mentioned in Section 2.1.4, Dr. Croft is co-PI on the Working Climate study for Science and Applied Science at UBC and Chair of the Applied Science Working Climate and Equity Committee. Moreover, Dr. Croft sits on the Search Committee for the Dean of Applied Science, the Community Service Learning and Women in Engineering advisory committees and the Faculty Association Status of Women Committee.

## **2.7 Obstacles**

No major obstacles have been encountered during the first part of the program. WWEST has been very successful in rolling out our programs and our focus is now on successful implementation, dissemination and sustainability management for our current activities.

# **3 Proposed Action for the Remainder of the Term**

## **3.1 Objectives**

Our primary objectives for the remainder of the term are to complete the programs we have started, measure and document their impacts, and disseminate the information to the broader community, transitioning programs to organizations who have the ability to sustain them in the longer term. These projects are focused upon three areas: industry, post-secondary, and a regional community network.

In industry, WWEST will continue to mainstream the leadership development and management awareness workshops created by the WinSETT Centre, focusing on their adoption by APEGBC or another similar organization as part of a professional development series. We are also continuing our research with Professor Toni Schmader of the UBC Department of Psychology, analyzing stress in the SET work environment. Additionally, the SSHRC grant discussed in 2.1.7 will be pursued, and the self-efficacy studies described in 2.1.3 will be completed.

At UBC, we will work to move our CSL courses and course components into the mainstream curriculum, introducing context and community relationships into coursework for a broader student base, increasing the extent to which they are being exposed and increasing the visibility of these programs. With regards to climate, Dr. Croft will also continue to serve as a leader in developing academe climate best practices at both UBC and other institutions in partnership with the other Chairs as indicated in 2.1.4 and 2.1.7. WWEST will also work with Engineers Canada on a 30 x 30 strategy, partnering with APEGBC and APEGY (Yukon) on local initiatives. We will also support the UBC Faculty of Applied Science in reaching their target to double the recruitment of women into engineering.

The WWEST Council and WWEST Partners program have greatly enhanced the community networks in BC and Yukon, networks that will continue to be developed and whose members will be encouraged to collaborate and build links that will continue beyond the Chair. The Creating Connections conferences are being transitioned to function independently, with rotating hosts and support from other groups. In 2015, for instance, Simon Fraser University will host the conference. These conferences are a natural gathering point for organizations involved with women in SET, and the bi-annual events will continue to ensure ties and connections are refreshed and renewed on a regular basis.

### 3.2 Expected Impact

The overall impact of the WWEST program is to build a well-connected, resilient, and independent network of supporters of women in SET, and to ensure that new initiatives, when proven effective, are mainstreamed into schools, industry, and the community. By mainstreaming the WinSETT workshops as continuing professional development programs through APEGBC, we ensure that these experiences will continue to be available to young female professionals. Success in mainstreaming can be measured by whether or not at least one workshop is offered per year after the conclusion of the Chair.

We will demonstrate and report the positive change in self-efficacy found through the studies in 2.1.3, and disseminate them widely in industry. The impact of this will be measured by the number of organizations who adopt the tested interventions.

CSL helps students understand their education in context and connects curriculum to wider social consequences. The impact can be measured by the percentage of Mechanical Engineering students who participate in at least two CSL activities, and the percentage of students in engineering at-large who have the opportunity to choose to participate in CSL.

The impact of the WWEST Partners program will be measured through the number of new partnerships and programs created.

Within academic institutions, the impact of the climate studies can be measured through the adoption of new policies at UBC and changes in faculty experiences. In addition, WWEST will impact student registration by working with regional engineering schools to adopt set targets and dedicate resources to increasing the number of females recruited.

### 3.3 Team Members

The WWEST team composition described in 2.4 is expected to remain stable throughout the remainder of the term with regards to positions. By emphasizing undergraduate student participation in our team and exposing them to our activities and research, we are creating leaders for diversity within UBC, within their future graduate schools (where applicable) and their future employers. Postdoctoral Fellow Amir Haddadi will continue to support Dr. Croft’s research program as well as outreach activities, as described in 2.4.

### 3.4 Timeline

The following Gantt chart lists our main projects and gives a timeline for completion within the chair mandate. Partnered projects will be sustained by others beyond the mandate of the chair. Lighter shading indicates transition time where the Chair will be in a supportive or caretaking/monitoring role.

Initiatives	Q3 '12	Q4 '12	Q1 '13	Q2 '13	Q3 '13	Q4 '13	Q1 '14	Q2 '14	Q3 '14	Q4 '14	Q1 '15	Q2 '15
Mainstream leadership development workshop												
Self efficacy research and dissemination												
SET workplace research and dissemination												
Mainstream CSL programs												
Academic climate study, dissemination and action												
Recruitment of women / participation in 30 x 30												
WWEST Partners												
WWEST Networks and transitioning												
Creating Connections – WWEST hosted												
Creating Connections – supporting external host												
CWSE Network: SSHRC PDG “Bridging the Gap” (lead)												
CWSE Network: Career Transitions												
CWSE Network: Institutional Indicators												
Dissemination of best practices and reporting												

## 4 Use of Funds/Annual Budget

Line Item	Proposal Budget		Revised Budget	
Revenue	-\$	210,000	-\$	230,000
NSERC Contribution	-\$	70,000	-\$	70,000
NSERC Post-Doc Support Contribution	\$	-	-\$	20,000
Sponsors and Supporter Contributions	-\$	70,000	-\$	70,000
UBC - Applied Science Contribution	-\$	70,000	-\$	70,000
Staff	\$	137,000	\$	155,500
Chair Holder (~40% Salary and benefits)	\$	62,000	\$	62,000
Project Manager (50% appointment)	\$	69,000	\$	35,500
Program Assistant (50% appointment)	\$	-	\$	24,000
Student Project Assistants (leveraged)	\$	6,000	\$	14,000
Research Support Post-Doc	\$	-	\$	20,000
Awareness and Outreach	\$	29,000	\$	35,000
WWEST Network - seed grants	\$	18,000	\$	18,000
Communication and Outreach	\$	6,000	\$	12,000
Workshops and Hospitality	\$	5,000	\$	5,000
Research Support	\$	24,000	\$	24,000
Social Science Research Support	\$	16,000	\$	16,000
CSL Education Researcher Support	\$	8,000	\$	8,000
Special Projects Funding	\$	20,000	\$	15,500

Changes in our annual budget reflect the following:

- The addition of the postdoctoral funding from NSERC.
- The split of funds for the 100% project manager slot into funding for a 50% project manager, a 50% program assistant, plus increased student project assistants, in order to more effectively use funds and utilize subsidized student support programs like Workstudy/Worklearn.
- An increase in our communication and outreach budget (including travel outside the lower mainland and subsidies for partners in remote locations to attend WWEST events in the lower mainland).
- A reduction of our “special projects funding” since fundraising for the Creating Connections conference has been successful, and industry sponsors have stepped up to host workshops and other events significantly reducing costs.