CENTRAL OHIO AFS AMERICAN FOUNDRY SOCIETY CHAPTER

The Foundry Reporter™

"To advance, through Research and Education, the Arts and Sciences relating to the Manufacture and Utilization of Metal Castings"

Vol.2010-01 www.afscentralohio.org January 2010

In this Issue:

Support Our Advertisers!

"In times of change, learners inherit the earth, while the learned find themselves beautifully equipped to deal with a world that no longer exists"

- Eric Hoffer -

Upcoming Event:

February 13, 2010
Dinner Dance/Winter Party

>> See page 10 for complete Schedule

Meeting Location (unless otherwise noted):
Holiday Inn - Worthington
7007 North High Street.
Worthington, OH 43085
(614) 436-0700

Times:
Board Meeting: 5:00 - 6:00 PM
Social Hour : 6:00 - 6:30 PM

Dinner Cost: $25 per person
(Students free)

RSVP: Steve Pinkstock
614.445.2174
Email:

srpinkst@ColumbusCastings.com
By Monday before the meeting

Program Details

Our Next Meeting is Thursday, January 21, 2010

the AFS student chapter at the Ohio State University

"Contributions of the AFS-OSU Student Body to the Metalcasting Industry"

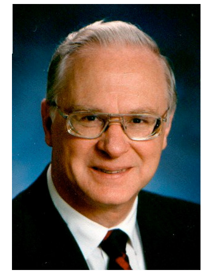
Two year ago, during the January 2008 AFS meeting, and again, last year, during the January 2009 AFS meeting, you may remember the AFS-OSU student members Evan Standish, Dan Owsley, Dave McCray, Dan Campbell and Sarum Boonmee giving presentations about their activities in the OSU Metalcasting Program. They reported on their experience in making chess figurines, and the OSU stadium, cast in aluminum from their own patterns and molds.

With the January AFS meeting becoming a tradition for the AFS-OSU students to report to the Chapter, we again will have a group of students present their progress. What advances have they made in this past year? What have they learned? What are they doing today towards their goals of becoming master metalcasters? Answers to these and other questions as well as reviews of their trials and tribulations – in other words updates, will again be the topics of this months AFS meeting.

Make plans now to join us for an interesting and insightful evening among your fellow AFS members and friends.

Mark Your Calendar for
February 13, 2010
AFS Central Ohio Chapter
Dinner Dance/ Winter Party
Watch for Details!

2010 - a new decade….



We are starting a new decade –twentyten- and if we count ourselves among the 90 percent following tradition, we've been making wishful New Year's resolutions for this coming year and the next ten years. However, there is a slight problem – according to follow-up polls more than 60 percent of those good intentions will have been broken or given up by the middle of January and by the end of March 90 percent of those good intentions will have been forgotten or abandoned.

But since you are not part of these polls and you are not average this will not happen to you – because you are committed and will take action. Right? You see, I am 100 percent sure that 2010 will be the most productive year of your life so far and you will enjoy better health, make more money and accomplish more than ever before in any year. And you are going to start today. Not tomorrow, but today, in fact d`o it right now.

Take a 3x5 card or piece of paper and write on it: "2010 will be the best year of my life." Sign it and place it where you can see it every so often.

By signing it you have made a promise, a contract with the part of you that wants to succeed and that commitment is the most important thing you can do today. It's the critical first step of the process of reaching all your goals. ☐

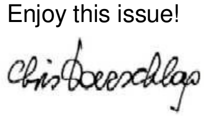
As reported by Bobby Gyesi, secretary of the AFS-OSU student chapter, on November 17 the AFS-OSU chapter hosted a special seminar "The coming boom in the global castings market". Presented by Michael Swartzlander, CEO of Casting Strategies LLC Inc. Columbus, OH. The event was attended by 17 students whose majors include Mechanical Engineering, Industrial Engineering, Arts & Material Science.(see photo below). Mr. Swartzlander touched on a wide range off issues related to the metal casting industry which include the good, bad and the ugly of the metal casting industry and the new economic order.

At this time we would again like to thank all of our repeat advertisers and those joining us again this season, who, in spite of the difficult times faced by our industry, contribute to our mission for the promotion of our industry and to provide training for our members and student projects. .

We are starting the new year with "The Foundry Reporter" reviewing material handling for melting in electric induction furnaces and presenting other topics that may be of interest to you.

As always, if there are certain topics or subjects you wish to raise or read about in future issues don't be bashful. Just send your comments to Editor@afscentralohio.org or let any of the board members know.

Enjoy this issue!



Chris Doerschlag
Editor

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Material storage, handling, conditioning and charging for melting in electric induction furnaces

Good materials storage, handling and charging principles are pre-requisites for an efficient melt department. Detailed considerations should always be given to them at the design stage—preferably in conjunction with the furnace supplier. The basic aim should always be to have a charge immediately available to the furnace requiring it. Any delay in charging results in lost metal output and increased energy consumption.

Design

Many systems have been developed, the design adopted depending upon several factors—including:

- The number, size and type of furnaces installed.
- The nature of the melting charge to be used.
- Site conditions.
- Whether preheating or any other form of charge conditioning is required.
- Cost—the selection of a system is often a compromise between the technically desirable and the economically acceptable.

Storage and handling

All systems, irrespective of the actual mode of material handling employed, generally include common storage and handling facilities:

- Primary bulk storage, with adequate means for unloading incoming transport.
- Day bins or hoppers positioned near the melting-furnaces and replenished from the bulk storage area— although in many instances separate primary bulk and daily service areas may not be necessary, a single area serving both purposes.
- Means for weighing charge make-up.
- Charging skips, buckets or other handling method for transferring the weighed material to the furnace with, possibly, an intermediate station for preheating or pre-drying the charges.

These notes are not intended to provide detailed descriptions of the many variations possible, but offer guidelines for consideration during the design and planning of an induction furnace installation.

Unloading and bulk storage

The system of unloading and bulk storage should be designed to avoid intermediate transfer areas and double handling. Incoming material may be discharged into the bulkstorage area direct from tip-up trucks, or transferred from rail wagons by magnet crane.

All materials should preferably be stored under cover—especially when they are not to be preheated, or where they may readily entrap or absorb moisture, or where they may readily oxidize—for example, thin section scrap, bales, borings etc.

All incoming supplies should be carefully inspected. Sealed containers such as gas cylinders, fire extinguishers, sealed tubes, shock absorbers, and hydraulic rams *must be removed,* since they are likely to cause an explosion if charged into the furnace—which can result in serious injury to personnel and damage to the plant. All harmful non-ferrous or other contaminants should also be removed.

The provision of storage bins, to allow different materials to be segregated and to save storage space, should be considered. These bins may be constructed with steel plate, concrete or timber retaining walls. Wooden beams have the advantage that they help to reduce noise; they are easily replaceable and, enclosed in a substantial steel framework, provide flexibility of bin size to suit changing needs.

In estimating the storage space required, a careful study should be made of all the factors determining the maximum amount of raw materials necessary for uninterrupted production—such as proposed output of finished castings, maximum rate of stock depletion to meet production requirements, and time required for delivery of raw materials from the supplier's plant to the foundry yard.

Day storage bins

Day-storage bins, when provided separately from a bulk storage area, should be located near it, and with direct access to it. They can be replenished by the main crane serving the bulk storage area, or by an auxiliary crane. The number of bins should be determined by the number of materials used, and their capacity should allow uninterrupted charging to be carried out during the melting shift. The possibility that the magnet may be used for other purposes, such as unloading, must be taken into account —as well as the fact that the crane might break down. It can, therefore, be advantageous to position the daily service bins at a higher level than the working-platform, since this allows materials to gravitate down a slope or chute to the weighing bucket or skip.

Transfer of materials

A wide variety of systems may be employed for conveying the charge materials from the day bins to the furnace, and these will generally include a means of making-up and weighing the charges. Where there is no preheating or predrying, charge handling is relatively straightforward. Techniques may range from simple, direct charging into the furnace by hand or by magnet crane, to fully mechanized systems with a programmed operating cycle requiring little or no intervention by foundry personnel.

Depending on circumstances, plant output, the number and type of furnaces, the nature of the charge materials, and initial cost, the

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transfer system may comprise cranes, lifts, overhead tracks, roller or vibratory conveyors, forklift trucks or a combination of such methods.

The weighing system will depend upon the method of stock handling and transfer. Some commonly used methods are:
• The materials are weighed and charged into the furnace direct—by overhead magnet crane equipped with a suspended dial weigher or load cells. The crane movements and weighing operations can be effected by remote control, if desired.
• The materials are weighed in charging skips or buckets (provided with dial scales) suspended from overhead tracks traversing the day bins—from which they may be filled either manually or mechanically. Alternatively, the charging skip or bucket may be carried on a mobile weigh car traversing the day bins, to a pickup point from which it may be transferred to the furnace by an overhead track or crane.
• The charges are weighed in a fixed weigh hopper, to which materials may be transferred by magnet crane or mechanical conveyor; the weigh hopper discharges into the charging skip or bucket, which may be conveyed to the furnace by overhead crane, monorail, wheeled trolley or other suitable means.
An important design consideration, when any type of automated materials handling and transfer system is to be installed, is that maximum use should be made of sound absorbing materials.

Charging the furnace

The charging procedures should be designed to prevent damage to the relatively fragile crucible wall, and to provide maximum safety for personnel and equipment.
The free fall of materials which may strike the furnace walls must be avoided. Depending upon the nature of the materials charged, sliding the charge from a tilting skip or chute is often preferable to dump charging, or drop bottom buckets can be fitted with special doors to protect the top of the furnace from the falling charge and to provide protection from splashing.
The movement of the molten metal in a bath accentuates the hazards associated with the charging of rusty, damp or oily materials onto a molten heel of metal, most of all when power is applied to the furnace. Controlled charging can be of some benefit, particularly if a layer of dry solid material is first charged, on which the less suitable scrap can lie and be preheated.
'Bridging' of the charges in the furnace must be avoided: addition of excessive amounts of charge to a molten bath can result in the upper part of the charge bridging across the furnace, and losing thermal contact with the pool of molten metal below. If the furnace operator does not observe the problem and takes remedial action, severe refractory damage can result—owing to excessive superheating of the molten iron. Particular care is required when charging material which contains components having a dimension more than one-third of the furnace diameter, or when dump charging fine particulate material (for example, swarf, borings) which should be added in relatively small batches.
The raw materials used have an important bearing on the charging technique and system adopted. For example, the possible presence of oil or other coatings or contaminants may dictate whether charge preheating or drying will have to be used, because of safety and environmental problems —irrespective of potential energy savings. The weight and shape of the scrap will affect the selection of both charging and preheating methods.

Basic methods of charging

The selection of a charging method depends upon the factors already enumerated; the commonest systems are:

Manual charging—Small furnaces, for example, medium frequency furnaces of small capacity, may be charged by hand; this has the merit of ensuring correct emplacement, - good packing density and minimum damage to the furnace lining.
Charging by magnet—Charging by magnet eliminates the need for a charge container and makes direct weighing simple, but its slowness restricts its use to small coreless furnaces, or to vertical channel furnace installations where the crucible diameter is large for the melting rate. Weighing by magnet generally gives only an approximate measurement; if small amounts must be added accurately, some manual trimming of the charges will be needed. Care must obviously be taken in discharging the magnet, to avoid splash and damage to the crucible.
Skips—Skips with front discharge are often used, as the charges can be readily preweighed into them and some control of the rate of charging into the furnace obtained; but a screen to protect the operator from splashing is desirable. Skips are often handled by overhead crane, but for small charge weights they can be on wheels. Another technique is to use a skip and elevator similar to, but much shorter than, the type used for cupola charging.
Vibrators—These are an efficient and cheap form of charging equipment, but they may not be able to handle all forms of raw materials simultaneously. Damage to furnace walls and metal splashing are reduced with this technique, and the use of a wheeled container—normally, running on rails—enables the charge to be preweighed while remote from the furnace. Vibratory feeders are usually employed for dispensing cast iron swarf into induction furnaces; then by matching rate of feed and power input to the furnace, maximum furnace utilization can be achieved.
Drop-bottom buckets—These are popular and may be used in conjunction with overhead crane, monorail or even fork lift truck. The base of the bucket is in the form of a skirt which protects against splashing; if deep enough, the bucket draws any smoke or fume upwards into an extraction system. The bucket should be held in the charging position until there is no danger from splashing or explosion.

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The drop of the charge being vertical, misses the furnace top; correct segmental design of the doors can protect the furnace top wall. However, very heavy pieces of charge material positioned at the top of the charge can cause metal splashing. The walls of the buckets may be flared outwards, to avoid the risk of charge bridging. Rapid charging can be effected, thereby improving furnace utilization.

Conditioning charge materials

If the charge materials are not to be preheated, they should be allowed to dry naturally by prolonged storage under cover. The possibility of drying the charges with warm air heated in a water/air heat exchanger designed to recover waste heat from the furnace water cooling system may be considered.

If the materials consist largely of steel bales, hollow ware etc., even prolonged storage will be inadequate to remove trapped moisture satisfactorily; then the installation of means for charge drying or charge preheating must be considered, if the materials are charged onto a molten heel of metal.

Cast iron swarf and borings and steel turnings containing high levels of residual cutting oil generate excessive smoke and cause metal splashing when charged into induction furnaces. They should therefore be treated thermally or chemically, or centrifuged, to remove cutting oils and moisture.

Sand on return scrap can give rise to serious problems of lining buildup during melting. Excessive oxide scale on scrap results in increased slag formation and lining wear. Scrap contaminated by scale, rust, sand, etc. may need a tumbling barrel or shaker conveyor to clean it.

Charge preheating

When wet, rusty and oily charge materials are added to a bath of molten iron in an electric furnace, there is a risk of metal being ejected from the furnace—or of an explosion; so the most important reason for preheating metallic charges is to ensure safe charging operations.

Preheating of charges can give other advantages:

• The range of scrap which can be accepted is increased, with possible benefits in cost and availability.

• Emission of smoke from the furnace when using oily or painted scrap is reduced, owing to the burnoff of combustible material during preheating.

• The potential melting rate of a furnace of a given rating is increased by raising preheat temperature.

• Operating cost may be reduced, when the cost of gas or oil consumed in the preheater is less than the cost of electricity consumed in the furnace to impart the same heat content to a given weight of charge.

There are four main types of preheater each offering advantages with particular types of material. The main features are summarized here; more detailed descriptions are available elsewhere.

Bucket preheaters—The preheater consists of the charging bucket and the means for heating. The special advantage of this type is that because the charge materials are heated in the bucket, this can be part of the conveyor system—passing through stages where it is filled, heated and emptied into the furnace. The method of conveying the bucket can be chosen to suit local circumstances.

Preheating times of 15-20 minutes are normal, charge weight and heating time being matched to the furnace cycle time. The permeability of the charge is important, since it determines the uniformity and efficiency of heating; it depends on the size and nature of the charge materials. Chunky pieces of scrap are ideal; small pieces of thin section scrap are more prone to oxidation and are likely to be blown out of the unit. Average final temperature of the charge may be between about 660 °F (operated mainly to dry the charge only) and 1200 °F (to obtain other benefits of preheating).

Vibrating conveyor preheater— This consists of a vibrating conveyor which passes a weighed amount of metallic charge, as a shallow bed, into a preheating furnace. One charge is accommodated within the length of the.

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preheating furnace, which is fired from the roof by multiple rows of high-velocity burners
The charge is weighed in a loading vibrating hopper, which then feeds the vibratory conveyor; by adjustment of the vibration of both conveyors, the operator can maintain a uniform depth of material, ranging from 6 to 15 inches, depending on the type of scrap being used. Light, permeable scrap can be piled more deeply than heavy chunks or plates. Typical heating times are 4-6 min, with a total cycle time of 8-10 min. Average final temperature of the charge is usually about 1020 °F.
Furnace charging may be effected by any of the following methods:

- Transfer charge bucket.
- Swivel preheater which charges pre-heated scrap straight into the furnace(s).
- Transfer car, equipped with a feed conveyor to charge a row of furnaces.

Continuous preheater—When the charge is in the form of bales, the temperature at the core of the bales must be high enough to evaporate water and oil and burn any non-metallic contaminants. This is generally not possible with the bucket or vibratory conveyor preheaters, as dwell times of 30-60 min would be necessary. In these cases, particularly where the charge material is in the form of mixed loose and baled scrap, a continuous preheater can be used—which is similar in operation and design to a continuous heat treatment furnace. The burners are normally in a duct, separate from the furnace chamber; this provides a low furnace temperature—typically, 930 °F—which minimizes oxidation of the charge material. A long dwell time of up to 60 min assures that a core temperature of between 300 to 400 °F is reached in the bales, to evaporate all the water and most of the oil and grease.

Revolving-drum preheaters—Cast iron swarf and borings are low cost charge materials for electric furnaces, but may only be used if they have suitably low levels of moisture and residual cutting fluids. Such material may sometimes be used without drying or cleaning when cutting oil contents are no more than about 2 per cent. Above this level, the excessive smoke and flame generated are unacceptable.

Treatment of these materials presents special heating problems, because of their high packing density; and the layers need to be kept as shallow as possible, for treatment to be reasonably quick. Specially designed rotating heating drums have been designed for this purpose, with varying degree of success. Heating time is usually about 3 to 5 min, and the final temperature 300 - 570 °F.

Summary: charge preheating—Since charge preheating techniques can provide a safer operating sequence for electric melting installations, with other potential benefits, the use of such a process should be considered during planning and development of electric furnace melting schemes. In this context, attention must be given to material handling, so that adequate means are provided for rapid transfer of the preheated charge to the melting unit; otherwise, full advantage cannot be derived from the preheating equipment.

In addition, the preheater cycle times must be correlated with the melting furnace performance and utilization. These operational aspects require thorough consideration at the planning stage of any new installation.

Adapted from BCIRA Broadsheet 176-6

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OSU-FEF Industrial Advisory Board meets with the Dean, College of Engineering

As you may know The OSU-FEF Industrial Advisory Board was established several years ago to solicit and lobby the management of The Ohio State University in support of FEF (Foundry Education Foundation) and specifically Dr. Doru Stefanescu, Ashland designated Research Professor and current FEF Key Professor at Ohio State.

The Advisory Board meets periodically and consists of 18 industry members, including GM and Ford, with our Central Ohio AFS Chapter being actively represented by 9 of our own chapter members. Greg MacIver, Global Marketing Director, Ashland Performance Materials and National Director FEF, is leading the group by planning and arranging meetings and discussions with OSU officials and presenting critical topics for review and consideration.

Helping students ….

Following the FEF motto of “Helping Students Become Leaders in the Metal Casting Industry” our own Chapter as a unit and individual member companies, as you have seen and read in the past, have given considerable and generous support to the OSU-FEF program. Every year scholarships are awarded by the Chapter to deserving students in the program and direct financial donations toward the purchase of equipment for the new OSU foundry lab have reached $32,000.00. Also equipment and engineering services were donated and a Student’s Advisory Committee has been established with John Harmeyer of Fisher Cast Steel Products, Inc. johnharmeyer@fishercaststeel.com (614.879.8325) leading efforts to help students connect with industry mentors.

There are two issues …

The two key issues in the preservation and continuation of the Metal Casting Program at Ohio State are the hiring and retention of a qualified new tenure track Professor for metal casting with a 5-10 year contract and sufficient paid foundry related research projects ($300,000 to $400,000 annual minimum) to cover maintenance for the program.

Currently the Metal Casting Program in the Material Science and Engineering Department at OSU is managed by Professor Stefanescu who joined the MSE department in August 2005 after serving in the Metallurgical and Materials Engineering Department at the University of Alabama for 25 years where his last position was that of Cudworth Professor of Engineering, Distinguished University Research Professor and Director of the Solidification Laboratory.

During his time at OSU he has been instrumental in efforts to rebuild the outdated foundry laboratory at OSU by soliciting the help of industry and going out of his way to find sponsors for the needed equipment and current technology. So far he was able to obtain new high speed continuous mixing equipment and vibratory table, a 75 kW electric induction melting furnace, roller conveyors, some badly needed instrumentation as well as $100,000 worth of a solidification software program. Additional equipment will be needed to modernize the foundry lab and build a Solidification lab.

Future Needs ….

Professor Stefanescu is thinking of retirement from his current work and obligations making it necessary to find a qualified replacement if the Metal Casting Program at OSU is to continue.

And that brings us back to the purpose of the OSU-FEF Industrial Advisory Board

By becoming more involved in the maintenance of the OSU Metal Casting Program, we, as representatives of our industry, must take the bull by the horns and assist the University as much as possible to find the next FEF Key Professor and look for paid research projects to fund the program. There are many other, more lucrative

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Comments and Rants…

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programs the University is involved in and the Metal Casting Program is certainly not on their list of priorities. Therefore, in order to help assure the education of young talented men and women to select our industry as a career we need to do our part in helping to assure that the right facilities and study programs remain available.

The Advisory Board has met in the past with Rudy Buchheit, Department Chair, Material Science and Engineering, to present the Board's concerns about the current situation and asking for consideration by OSU to maintain and continue the Metal Casting Program at OSU, which is currently part of the MSE offered curriculum. The turnout and interest in the meeting of the board members was indicative of our common interest and willingness to offer assistance to OSU paving the way for additional meetings to present our case in more detail and to "higher management".

Gregory Washington

This then, took place on December 2, 2009 in another meeting, arranged with Gregory Washington, Dean of the College of Engineering, since the Department of Science and Engineering is part of the College of Engineering. The Advisory Board, again headed by Greg MacIver, Ashland Performance Materials, was represented in force and during the two hour meeting the Dean was brought up to speed about the purpose and function of FEF. Data was presented showing that FEF support to OSU since 1949 included $485,000 to OSU and students, there have been 458 student participants and 62 graduates currently work in the Metal Casting Industry, as well as other relevant information about FEF involvement with OSU.

Dean Washington expressed his appreciation for the Advisory Board's activities and of the detailed background data and was admittedly not aware of all the FEF activities presented.

He mentioned that the driving force for OSU programs are the students and funded research. Interested students evaluate the economics of an industry to decide if it is a desirable field of study for them or not, he said. They ask, what are the job opportunities in the industry after graduation? What are the possible career opportunities in the industry? What about job challenges and career advancements?

Funded research of course is needed to be able to cover part of the expenses of a program such as faculty, operating expenses and functions, he said. Also, OSU programs are dependent on state funding. Can we convince the legislators to appropriate funds for a specific program?

Regarding his function in any program, the Dean said, is to evaluate and approve the recommendations made by his team members which include the Department Chair and contributing staff because it is they that will have to manage such programs and deal with day to day activities.

The meeting concluded with a mutually felt positive note with plans for continuing the dialog. ☐*FR*

2009/2010

Chapter Events Schedule

September 17, 2009
"Global Metal Casting Markets & New Technology Trends",
Jim Archibald, Sr. Business Development Manager
ASHLAND CASTING SOLUTIONS

October 15, 2009
“New Concept for Low Volume Casting Finishing”,
John Kuhn, Foundry Automation Specialist
RIMROCK CORPORATION

November 20, 2009
TOP MANAGEMENT NIGHT
Plant Tour, Ariel Corporation
Mt. Vernon, Ohio

December 2009 - No meeting

January 21, 2010
AFS-OSU Student Presentation
Jon Tinker, et. al., AFS OSU Student Chapter

February 13, 2010
Dinner Dance/Winter Party
Holiday Inn, Worthington, Ohio

March 18, 2010
TBD

April 15, 2010
"PAST CHAIRMENS NIGHT"

May 20, 2010
Plant Tour Allen Refractories
Pataskala, OH

June 12, 2010
Annual Golf Outing
Oakhaven Golf Club - Delaware, Ohio

June 19, 2010
Change-over Meeting
Eaglesticks Golf Course - Zanesville, Ohio

Industry Events

February 2010:

10 - 13: AFS Southeast Regional Conference; Cherokee, NC

March 2010:

20 – 23: AFS/NADCA CAST EXPO 2010; Orlando, FL

April 2010:

18 – 20: CISA Spring Meeting; Marco Island, FL

May 2010:

5 – 7: 2010 Metalcasting Industry Government Affairs Conference; Washington, DC

11 – 13 : Ductile Iron Society Annual Meeting; Surry, BC, Canada

13 – 15: AFS Northwest Regional Conference; Whistler, BC, Canada