

## A COLLEGE-LEVEL TRAINING PROGRAM FOR AVALANCHE SAFETY WORKERS

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**ABSTRACT:** Colorado Mountain College (CMC) is a higher education system with 11 campuses serving over 30,000 km<sup>2</sup> of north-central Colorado. The college offers two- and four-year degree programs, certificate programs, and a variety of technical and continuing education opportunities. The CMC Timberline Campus in Leadville, Colorado, in collaboration with the Colorado Avalanche Information Center, has developed an innovative Avalanche Science Program offering a Certificate of Occupational Proficiency as a Snow Weather and Avalanche Field Technician. This undergraduate-level, two-year program provides students with a unique and immersive educational experience in an ideal location with access to substantial educational resources. Students will graduate from the program with significant exposure to the latest in industry practices across a spectrum of operational applications and will be job-ready, possessing a core set of technical skills, risk management awareness, and fundamental knowledge in snow science.

**KEYWORDS:** Avalanche education, professional avalanche worker training, avalanche certification

### 1. INTRODUCTION

CMC in Leadville Colorado has developed an innovative Avalanche Science Program offering a Certificate of Occupational Proficiency as a Snow Weather and Avalanche Field Technician. This new program provides students a unique and highly immersive educational experience in an ideal location with access to substantial educational resources.

CMC Leadville at 3,050 m elevation is a particularly well-suited location for this program in the heart of the Colorado Rockies with access to high-elevation seasonal snowpack, remote telemetered weather stations, a close partnership with the Colorado Avalanche Information Center (CAIC), and access to leading industry professionals and partner organizations. The Leadville campus also offers a list of related educational programs such as Ski Area Operations, Outdoor Recreation Leadership, and Natural Resource Management

While there have been some notable advances in both professional and recreational avalanche safety training in the U.S., much of the baseline or core skills that avalanche workers need are addressed in relatively brief educational modules or acquired on the job. How these skills

are passed to students and workers is variable in both delivery and content. What the CMC program does is fill a niche in providing foundational skills for future snow and avalanche workers and better prepares them for success when they do progress into the workplace. The program provides a long-term preparatory program unlike any other in existence in the U. S. Students build their knowledge base and competence in avalanche safety work and develop skills key to long-term, safe careers. The program is targeted at aspiring, as well as existing avalanche safety workers, and it provides core knowledge and skills in an environment and timeline that is unique.

### 2. PROGRAM HISTORY AND DEVELOPMENT

#### 2.1 Program History

In 2009 Dr. Ethan Green (Director of the Colorado Avalanche Information Center, CAIC) and Dr. Kelly Elder (US Forest Service) approached CMC Leadville campus administration and outdoor studies program faculty with the idea of collaboratively developing an in-depth, professional-level course of study in avalanche science. The concept was endorsed by college administration and design and development of this new program began in earnest in 2014 with a core program design group comprised of four dedicated parties: Greene, Elder, Lazar, and chaired by outdoor studies faculty Roger Coit.

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The CMC Avalanche Science Program's mission is to supplement (or address gaps in) the US avalanche education model, train professional field workers to a significant level of competency, and strive to support a reduction in US avalanche worker mortality and morbidity.

### 2.1 Program Development

The design group embarked on a more than three-year process in building a completely new program from the ground up and engaged in a Design in Reverse process with attention to aligning curriculum with workforce needs (see Figure 1).

around avalanche terrain. A series of questions was posed that measured the range of job-related skills and knowledge needed and the results were used to develop the following list of Outcomes:

Program Outcomes List:

1. Core Knowledge and Skills: Students will demonstrate college-level knowledge emphasizing communication, math, science, and critical thinking as well as basic mechanical skills and tool use.

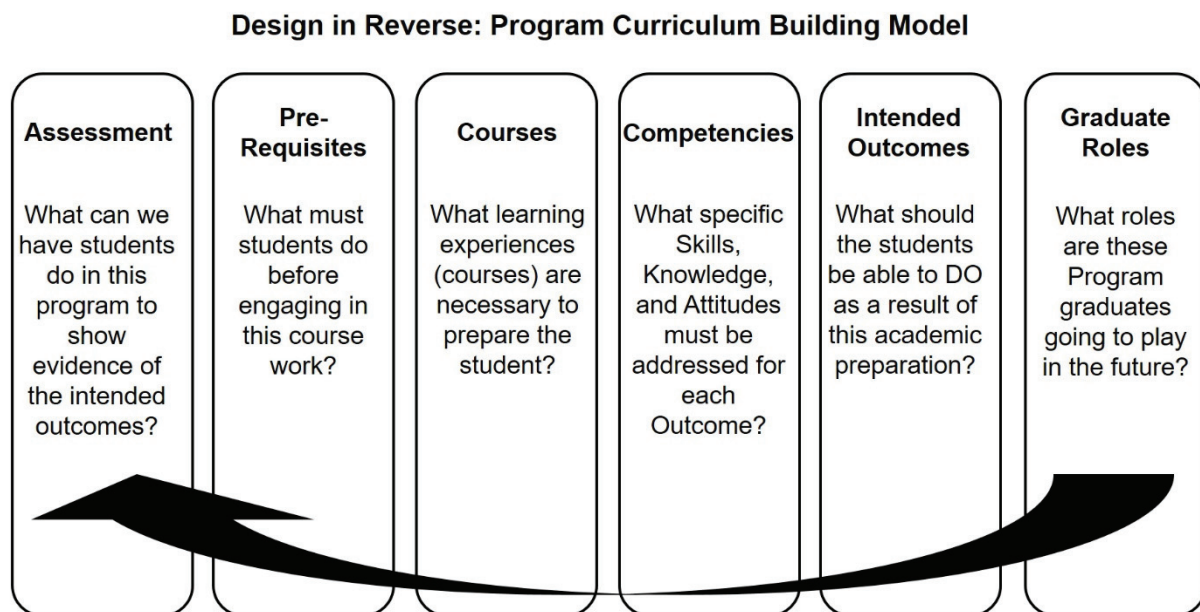


Figure 1. Design in Reverse Model (Stiehl, 2005).

**Graduate Roles:** *What roles are these Program graduates going to play in the future?* Program graduate roles identified spanned a wide range of occupations that involve work in and around avalanche terrain: Ski area snow safety program worker/ski patroller, university technician/research assistant, government technician/researchers, regional/local avalanche forecaster, transportation avalanche forecaster, mountain guide (ski, alpine, snowmobile, snowcat, helicopter), educator, environmental scientist, public safety (fire/law/EMS/search and rescue), and military specialist.

**Intended Outcomes:** *What should the students be able to DO as a result of this academic preparation?* To answer this question the design group conducted extensive industry polling of more than 40 industry leaders who supervise workers whose job duties take them in and

2. Field Observations: Students will be able to produce high-quality, field-based observations of snow, weather, and avalanches.
3. Safe Travel: Students will be able to evaluate and employ safe, efficient winter travel and travel in avalanche terrain.
4. Rescue and First Aid: Students will be able to model efficient small-group avalanche rescue including victim care and transport. Additionally, they will be able to explain the organization of a large-team rescue.
5. Leadership: Students will employ a range of leadership skills and abilities such as self-reliance, anticipation of 'human factor' effects, expedition behavior, and professionalism.

6. Snow Science: Students will be able to summarize fundamental snow, weather, and avalanche principles and processes.
7. Forecasting: Students will be able to employ an elementary weather and avalanche forecasting process for a range of conditions and contexts.
8. Operations: Students will be able to describe and evaluate a range of operational avalanche planning and mitigation activities.
9. Risk Management: Students will be able to describe and model a range of risk management concepts and techniques including risk identification, assessment, management, mitigation, and communication.

Competencies: *What specific skills, knowledge, and attitudes must be addressed for each Outcome?* Again, relying upon industry polling and the identified outcomes, the design group identified multiple competencies for each listed outcome.

Example list of competencies for the outcome-Rescue and First Aid:

- a. Perform a rapid and efficient small-group rescue
- b. Understand the incident command system as it relates to avalanche rescue
- c. Participate in an organized avalanche rescue effort
- d. Relate current best practices in avalanche victim resuscitation
- e. Demonstrate basic care and transport for patients in winter rescue
- f. Prioritize and model rescuer safety
- g. Identify and use state-of-the-art avalanche rescue tools and equipment

Courses: *What learning experiences (courses) are necessary to prepare the student?* A slate of courses comprising the program was built from this list of competencies. This course list addressed the content and skills to be taught and the learning hierarchy (Bloom's taxonomy) was charted for each competency. Estimations of instructional time were made based on the team's previous experience as educators and input from colleagues in higher education. From this work we identified 11 courses comprising 21 college credit hours and 500 hours of instructional time. This list of courses was mapped over a two year schedule running from late autumn into spring each year, matching the seasonal snowpack progression.

Avalanche Science Program Course List:

SAO 162 - Snow, Weather, and Avalanche Field Technician Program Introduction  
MET 150 - General Meteorology  
SAO 163 - Snow and Avalanches I  
SAO 164 - Snow Weather and Avalanche Observations I  
SAO 165 - Forecasting I  
SAO 180 - Internship  
SAO 263 - Snow and Avalanches II  
SAO 264 - Snow Weather and Avalanche Observations II  
SAO 265 - Forecasting II  
SAO 266 - Avalanche Safety Operations  
SAO 279 - Portfolio Seminar

Prerequisites: *What must students do before engaging in this course work?* From our work in defining course learning hierarchies, and the need to have entering students who are academically prepared, mature, and who have completed a list of important certifications, the program developed these prerequisites:

Academic- Entering students will have completed college-level coursework in mathematics, English composition, communications, and computing.

Certifications- Entering students will hold current certifications in CPR, Wilderness First Responder, Level 1 Avalanche Safety, and Avalanche Rescue.

Prospective students are also vetted on relevant education and work history, wintertime backcountry travel experience and ability, experience in observing snow/weather/avalanches, and documentation of physical fitness.

Assessment: *What can we have students do in this program to show evidence of the intended outcomes?* The program has constructed its assessments of student learning based upon the listed outcomes, competencies, and learning domain, and includes both formal and casual instructor evaluations as well as student self and peer evaluation. The student's learning progression is assessed through multiple and varied avenues, from traditional written examinations to individual and group projects, evaluation of student competency across a range of psychomotor skills, and learning portfolio development to list a few. Assessment of the program itself is also employed to evaluate efficacy in meeting stated outcomes and is used for continuous adjustments of curriculum, content delivery, and student preparation.

### 3. PROGRAM FEATURES

The program has integrated a variety of features that provide a robust learning experience for students:

**Hybridized Course Delivery-** We have built courses as hybrids, blends of on-site and online learning that are scheduled with the wintertime worker in mind. Hybrid courses optimize working student's time away from their job while still allowing for direct instructor interaction. Students visit campus each winter for three intensive on-campus sessions lasting from 6 - 10 days each. Prior to, between, and after each of these sessions, students remain engaged with their coursework through online, live (synchronous) classroom sessions, as well as independent (asynchronous) coursework. Students remain connected to their instructors and peers for the duration of the program, promoting a mentored, collaborative learning experience important in developing competent snow safety workers.

**Student Portfolios of Learning-** The program employs a portfolio-based learning model where students, guided by a faculty mentor, construct a summary of their learning experience. Student portfolios of learning serve to provide formative feedback during coursework and summative assessment when student portfolios are completed. These learning portfolios will also serve as evidence of student competencies and learning in support of job-seeking after program completion.

**Industry Internships-** During the second year of the program, students engage in workplace internships at a variety of different snow and avalanche safety operations. These internships serve to provide student exposure to the broader industry in a variety of operational contexts where they can observe various snow and avalanche safety worker roles.

**Extracurricular Activities-** Students are encouraged to engage in a variety of activities outside of the program that expose them to the broader snow and avalanche safety industry. They are provided opportunities to serve as snow safety ambassadors to the lay public, assistants for avalanche education courses, research assistants, and other activities related to the broad range of professional snow safety and snow science roles.

**Program Location and Resources-** CMC Leadville is modern college campus in a particularly well suited location for this program.

It sits high in the central Colorado Rocky Mountains with significant permitted access to a wide variety of terrain and a consistent seasonal snowpack. The campus maintains two remote telemetered weather stations, as well as an on-campus snow study plot and manual weather station that are integrated heavily in program activities. The college offers a list of related programs of study that complement the student who wishes to expand their education into other avenues such as: natural resource management, outdoor studies, ski area operations, or a catalogue of traditional academic programming. The campus is also host to a CAIC forecasting office, which provides students exposure to working avalanche forecasters.

**Unique Courses-** The program integrates a list of courses that include topics not commonly offered or delivered in such depth in typical U.S. avalanche education. Courses such as general meteorology with a mountain weather focus, weather and avalanche forecasting, and avalanche mitigation operations provide a wide range of educational exposure. Additionally, the program is one of six professional avalanche safety course providers recognized by the American Avalanche Association. Students are eligible for the new U.S. avalanche education professional track certification in addition to their program certificate.

**Risk Management Practices-** As a component of student coursework, students are exposed to industry-leading risk management practices and incorporate those practices into both group and independent fieldwork. Students are prepared for fieldwork throughout their studies and are versed in self-rescue, first aid, and equipment troubleshooting. Furthermore, the program employs a fieldwork safety plan that includes GPS emergency messaging devices and real-time fieldwork monitoring by faculty.

### 4. SUMMARY

The program completed a successful first year of courses with a cohort of eleven students who all finished year-one coursework and received Professional Level 1 certification. The program curriculum and educational delivery were rigorously reviewed by the American Avalanche Association and the program successfully received professional course provider status. Students completed in-depth end-of-year evaluations of the program, faculty, and courses, which are providing valuable feedback for program assessment and refinement of the educational product. The early success of this

program is the result of a dedicated faculty, talented and committed student cohort, supportive college administration, curriculum and schedule designed to work for a variety of needs, and a near-perfect mountain location.

## 5. REFERENCES

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