



Photos by Joan Eaton

The Science of Snowmaking

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Eric Haynes Twerdahl

The Adventures in Learning Science Pub series began its fall season on September 11, 2024, at 6 PM in Galligan's Pub with a presentation about the Science of Snowmaking. This session was open to AIL members with about fifty in attendance. After Nina Tasi gave a few introductory remarks and reminders of upcoming events, June Fichter introduced the evening's topic and the respective presenters.

The presenters from Mount Sunapee Resort included Kris Dubaere, snow services manager, and Caleb Chipman, assistant manager. Chris Corliss, director of operations, was also on hand to assist in answering questions. Kris gave a brief profile of his background and experience with mountain operations, including some 38 years of experience at Sunapee in various capacities. He recounted that during his tenure, Sunapee was owned and operated by the State of New Hampshire until about 1998, when Okemo Ski Resort took over. Later, in 2019, Vail Resorts Inc. consolidated both into a group that now includes 42 ski areas across the U.S. Caleb has been with Sunapee for 25 years, also serving in many capacities with the overall operations of the very complex snowmaking equipment and systems.

Snowmaking is both an art and a science. The key components include an abundance of water, and Sunapee is lucky to have Lake Sunapee as an unlimited source. The second requirement is for efficient water pumping and pressure management to be sure sufficient water supplies reach far up the various slopes to the summit, and that requires very robust pumping at several stages under very, very high pressures. And, importantly, another parallel system provides compressed air, also at very, very high pressures. Many varieties of stationary snow guns are strategically placed and optimized for the given terrain, while other snow guns are moveable to address wider terrain.

Much of the science of snowmaking involves proper temperatures coupled with suitable ambient humidity. This relationship is called "wet bulb" and typically means snow can be made at 26 degrees with moderate to low humidity. Another important characteristic involves the delivery of highly compressed air at the site of the snow gun nozzles. The water pressures are sufficient to push the water mist out of the gun, yet water won't freeze on its own without the help of the pressurized air. When the air is released along with the water, by virtue of the principles of evaporative cooling, the temperatures fall to extremely low levels, allowing the necessary crystals to form thus allowing surrounding water particles to attach to grow larger crystals before the resultant "snow" crystals fall to the ground.

How does natural snow fit in? Kris explained that the machine-made crystals are much denser than natural snow crystals, and while the machine-made snow mixes very well with the natural snow, still the machine-made snow provides a better base overall for soon-to-follow natural snow and more machine-made snow that will come during the ski season. So, getting the machine-made snow started earlier in the season as

soon as the "wet bulb" temperature and humidity conditions are right, is preferable. Kris said that for our region, such conditions hopefully start during the second week of November.

Caleb added that as snow gun equipment wears out, newer guns have been developed that use less power to achieve similar results. If the air temperatures and overall weather are cooperative, then more snow can be made, hopefully supplemented with natural snow, all before the holidays. That makes everyone happy and "relieves the headaches."

But how does climate change affect snowmaking? Caleb mentioned that six inches of rain in late December last year, for example, ruined much of the progress up to that point. So, the largest variable is the behavior of weather especially in the early part of snowmaking in the late fall. Clearly, more warming spells occur, and those are very unpredictable. So, weeks of steady progress can be negated by just a few days of warm rainy weather.

Kris mentioned a few interesting statistics. It takes about 200,000 gallons of water to make one acre of snow a foot deep. During the season, they project using about 160 million gallons of water. That could go up to 250 million gallons. If all that was used on just one day, it would drop the level in Lake Sunapee by 1.5 inches. So, the Sunapee ski area is very lucky to have such a seemingly unlimited water source compared with other areas with much less availability.

Are any supplemental chemicals used in the snowmaking process? Chris Corliss explained that while they have tested the use of certain chemicals such as enzymes that also help in "nucleation," which jump-starts the formation of ice crystals with less dependence on compressed air, still Sunapee's systems do not need this approach which is used by some of the western ski areas. Also, avoiding any supplements is preferable given the watershed characteristics adjacent to Lake Sunapee and the perception that such additives might be bad for the environment.

Are there manpower shortages that affect the snowmaking capacity? Kris mentioned that the staff is spread very thin, working 12-hour shifts. There are ten crew members that make all this happen. It is difficult to find personnel who can take on this kind of work. It takes determination, and Caleb said the teamwork is unparalleled. He mentioned that difficult weather conditions, especially at night and the ever-present dangers of working around this kind of equipment with its high-pressure systems and very high-power demands make for a very challenging work environment.

In wrapping up, Kris and Caleb mentioned that the economics of Sunapee do not depend on surrounding trail-side real estate. They know that there are competing ski areas that do a fine job of snow making, but Sunapee's team does an exemplary job given the aging and non-automated infrastructure. Yes, they would like to have upgraded equipment, yet they feel this team can make better snow and more of it than just about anybody else. The pride in what they do really shows!

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